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20925

DP/ID/SER.B/732
13 January 1995
ORIGINAL: ENGLISH

148 p
Celine
Frage
2001

**HIGH-LEVEL ADVISORY SERVICES TO THE GOVERNMENT OF COSTA RICA
FOR ECOLOGICALLY SUSTAINABLE INDUSTRIAL DEVELOPMENT**

SI/COS/93/801

COSTA RICA

Terminal report*

Prepared for the Government of Costa Rica
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

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* This document has not been edited.

V.95 50244

EXECUTIVE SUMMARY

From August through mid-December 1994, UNIDO engaged three international experts to provide high-level advisory services to the Government of Costa Rica for the preparation of Sustainable Industrial Development (SID) policies. This assignment was undertaken in close cooperation with the counterpart staff and national experts from the Technology Management Center of Costa Rica (CEGESTI), government institutions, as well as the industrial and academic sectors. The purpose of the SID project was to support the development of policy measures for pollution prevention and control in industry within the framework of sustainable and competitive industrial restructuring.

For the identification of SID policy options in the national context, the project team developed a methodology involving the description of the industrial life cycle in Costa Rica and its environmental interactions, both from the point of view of the obligatory approach from the government and the voluntary initiatives from the industry. The potential application of the various options identified was researched using the food industry as a case study and, particularly, 16 industrial plants covering the dairy industry, processing of vegetable oil, manufacturing of flour products, sweets and chocolates, canning of vegetables and fruits, meat and fish processing and packaging.

The team found that the most critical environmental issues in Costa Rican food processing plants are: excessive use and waste of water; inefficient utilization and reuse of valuable organic matter, which finds its way to often overloaded waste water treatment plants or waste dumps; excessive use and waste of packaging material, with very limited in-plant reuse and poor post-consumer recycling; and, to a lesser extent, excessive use of electricity. These wasteful practices are not discouraged by the current emphasis on "end-of-pipe" technologies and a single-media approach found in environmental legislation and consulting services.

There are, however, promising signs that this situation is changing. The government is convinced of the need for a sustainable development approach, and it is at present, among other actions, issuing EIA and waste management regulations with a greater focus on prevention. The new regulations on waste water are also flexible enough to allow industrialists to submit an action plan for a gradual, and more effective, compliance. Furthermore, it was found that the entrepreneurs themselves are looking at waste minimization and resource efficiency as the means for reducing pollution and saving money.

On the basis of substantial consultations with the government and the industrial sector, and research work on the situation of the food industry, the project team produced a list of potentially applicable SID policies. This list was prioritized and, through further consultations with the project's Select Group, a set of five policies was developed as the SID team's policy proposals.

The proposed sustainable development policies for Costa Rica are the following:

- strengthening of the environmental sanitation division of the Ministry of Health;
- strengthening of the new National Commission of Environmental Impact Studies;
- development of consulting capacity on sustainable development;
- involvement of industry in a voluntary environmental code of conduct;
- establishment of soft credits and other financial incentives for SID projects.

Two additional policies were identified as suitable and viable, namely a restructuring of the water and electricity rating, which is already being pursued by the corresponding Costa Rican facilities and, closely related to this, a program to encourage the efficient use of water and electricity. Information was insufficient during the project to define these policies in detail, but the SID team strongly recommends their further development.

In preparation of the final report, and in cooperation with the Sectoral Council for Sustainable Development, the Chamber of Industries and the Chamber of Food Industries, the project team organized a one day seminar on "Sustainable Industrial Development in Costa Rica" on 7 December 1994. The findings of the project were presented to 59 representatives of the government, industry, the academic sector and donor organizations, who proved pleased with the outcome of the project. Valuable comments were offered on the proposed policy options, which were generally considered feasible in the Costa Rican context.

The SID policies and their gestation process are described in the present report. An implementation path has been laid out for each policy in order to facilitate the procurement of financial resources and to encourage their execution.

The project team believes that the successful implementation of the proposed policies can only be achieved through a decided intervention of the counterpart institutions. For this purpose, CEGESTI's action would be particularly valuable.

Table of contents

<i>Theme</i>	<i>page</i>
1. INTRODUCTION.....	1
1.1. The brief.....	1
1.2. Response to the Terms of Reference.....	1
1.3. Background.....	2
1.4. Legal and institutional framework.....	2
1.5. Sustainable Development Initiatives in Costa Rica	3
1.6. Report contents	6
2. METHODOLOGY	6
2.1. Approach	6
2.2. Selection of the food sector and case studies.....	9
2.3. Diagnosis of the food processing industry in Costa Rica.....	10
2.3.1. Overview of food processing enterprises	10
2.3.2. Water use methods and activities.....	10
2.3.3. Organic solid waste management.....	12
2.3.4. Product packaging.....	12
2.3.5. Other issues.....	13
2.4. Meeting with the Select Group	15
2.5. One day seminar on "Sustainable Industrial Development in Costa Rica".....	15
3. POLICY OPTIONS AND ASSESSMENT	16
3.1. Introduction to the policy framework for SID	16
3.1.1. Underlying principles.....	16
3.1.2. Why is industry currently not sustainable?.....	16
3.1.3. What balance is sought between obligatory and voluntary measures?.....	17
3.1.4. What techniques and technologies will achieve SID?	18
3.1.5. Menu of policy options for SID	18
3.2. Description and assessment of policy options.....	19
3.2.1. Institutional policies	20
3.2.2. Management policies.....	22
3.2.3. Financial and economic policies.....	31

4.	POLICY RECOMMENDATIONS	35
4.1.	Proposed Sustainable Industrial Development policies	35
4.1.1.	Strengthening the Ministry of Public Health	35
4.1.2.	Strengthening of the EIA commission	47
4.1.3.	Strengthening of consultancy capabilities	55
4.1.4.	Voluntary Corporate Code of Environmental Conduct	61
4.1.5.	Subsidies and soft loans for clean and/or more efficient technologies	66
4.2.	SID projects for the food processing industrial subsector	78
	4.2.1 Introduction	78
	4.2.2 Water use improvement	78
	4.2.3 Organic solid waste management	79
	4.2.4 Packaging	80

GUIDE TO ACRONYMS¹

AyA	Water and Sewer Authority
BID	Interamerican Development Bank
CACIA	Chamber of Food Industries
CCAI	Costa Rican Consultants Association
CEGESTI	Center for Technology Management
CITA	Investigation Center for Food Technologies
CNFyL	National Electric Power Company
CONACE	National Commission for Energy Conservation
CONAMA	National Environmental Commission
CONEIA	Commission for Environmental Impact Assessment
CSD	Commission for Sustainable Development
DBO	Biological Oxygen Demand
DQO	Chemical Oxygen Demand
DSA	Division of Sanitary Engineering of MINSAL
ECODES	National Conservation Strategy for Sustainable Development
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESID	Ecologically Sustainable Industrial Development
FSTI	Fund for Sustainable Technology Innovation
GLH	General Law of Health
GTZ	German Technical Assistance Program
ICAFE	Coffee Institute of Costa Rica
ICE	Costa Rican Institute of Electricity
INBio	National Institute of Biodiversity
INVU	National Institute of Housing and Urbanization
LPWL	Law for the Protection of Wildlife
MEIC	Ministry of Economy, Industry, and Commerce
MEP	Ministry of Public Education
MICIT	Ministry of Science and Technology
MIDEPLAN	Ministry of Planning
MINSAL	Ministry of Health
MIRENEM	Ministry of Natural Resources, Energy and Mines
PAHO	Pan American Health Organization
SID	Sustainable Industrial Development
SNE	National Electricity Service
UCR	University of Costa Rica
UNIDO	United Nations Industrial Development Organization
WWTP	Wastewater Treatment Plant

¹ Note that many of the acronyms are based in full or in part on the Spanish translations of the phrases, names of institutions, or titles of activities for which the acronym stands.

1. INTRODUCTION

1.1. The brief

The purpose of the Environmentally Sustainable Industrial Development Project is the introduction of policy measures by the Government of Costa Rica for the prevention and reduction of pollution emissions in a selected industrial sector, within the framework of ecologically sound and competitive industrial restructuring.

UNIDO engaged three international experts to provide high-level advisory services to the Government of Costa Rica for the preparation of ESID policies, in close cooperation with counterpart staff and national experts from the Technology Management Center of Costa Rica (CEGESTI) and government institutions such as the Ministry of Science and Technology, the Ministry of Natural Resources, Energy and Mines (MIRENEM), the Ministry of Economy, Industry and Commerce and the Sectoral Council for Sustainable Development. The international team included Mauricio Athié, Principal Consultant at Environmental Resources Management (ERM), acting as project leader and institutional expert; Daryl Beardsley, expert on environmental management and Albert Keesman, a CEGESTI expert on competitiveness and sustainability in industrial management. In addition to the international experts, the team included Marianella Feoli, a Costa Rican CEGESTI staff member with a background in industrial engineering. This is the report of the work undertaken under the ESID project.

According to UNIDO's definition, Ecologically Sustainable Industrial Development is an approach to industrial development which allows for reconciling the demands of population growth, the desire for continued industrial development and the need to preserve the environment. As such, ESID involves social, economic, political and environmental components which broaden its purely ecological scope. The ESID team, therefore, broadened the scope of the recommended policies, in order to cover all the above aspects, to those of Sustainable Industrial Development, which will be referred to, throughout this report, as *SID*.

1.2. Response to the Terms of Reference

The terms of reference of the project involve the preparation of a sustainable industrial development strategy for Costa Rica, comprising the following activities:

- Consultation with industry representatives, government officials and research organizations in order to select the industrial sector to be studied and analyzed by the project.
- Assessment of the most feasible policy options for Costa Rica, making use of case studies of Costa Rican firms which have successfully implemented environmental benign measures.
- Gathering of information and data specifically on the local costs of pollution abatement, technologies, including the following:
 - existing efficiency and emission standards for each major pollutant and a qualitative assessment of their implementation;

- existing industrial, fiscal, credit and monetary policies that affect the materials usage products and waste production and production processes of the sector.
- Analysis of product and market opportunities for existing and future Costa Rican products which use environmental sound processes.
- Participation in the meeting of the "Selected Group" to discuss the elements of the policy measures to be introduced.
- The formulation of policy measures - economic incentives and pollution emission standards and the definition of the institutional requirements for the formulation and implementation of a comprehensive SID policy.
- Participation in the two day conference to discuss, fine-tune and validate the draft policy recommendations for the selected industrial sector as well as its implications for a more comprehensive SID policy.
- Finalize the policy recommendations for the selected industrial sector as well as the institutional requirements for SID, and prepare the final report of the assignment.

The project team undertook all the above activities and, in order to respond truly to the SID paradigms, it focused on policies which emphasize pollution prevention, waste minimization and efficient use of resources within a multi-media approach.

1.3. Background

The present effort to come to policy recommendations for Sustainable Industrial Development was set in motion in the latter half of 1993 by the Costa Rican Ministry of Natural Resources, Energy and Mines (MIRENEM), in cooperation with the Ministry of Science and Technology. The Technology Management Center of Costa was put in charge of the formulation of the project as well as the negotiations with UNIDO, which was identified as a suitable partner and source of technical and financial support in the execution of the project. The change of the Costa Rican Government in May 1994 caused some delay in the execution of the project, but at the same time the effort gained even more importance because of the heavy focus of the administration of President José María Figueres Olsen on the implementation of the principles of Sustainable Development in all sectors of society.

1.4. Legal and institutional framework

In Costa Rica, no General Law of Environment exists as a comprehensive basis for environmental legislation. This has been pointed out in several consultations as proof of a serious lack of long term legislative planning. Decrees have been repeatedly used by different administrations to implement environmental policies, but, as they can be issued by the ministries themselves, they favor short term legislation. Long-term measures in favor of Sustainable Industrial Development would need the support of broader based Laws, and they need to be enacted through a lengthy approval process of the Parliament. However, an amendment to the Constitution was approved as a fundamental law to give the right to a healthy and clean environment. A more detailed description of the Costa Rican legal system can be found in Attachment I.

Present legislation does not include positive incentives to promote environmentally sustainable development in industries or environmentally sound products or services. Instead, environmental protection by industry is promoted through restrictions and penalties.

Occasionally the Government, in cooperation with the private sector, pursues agreements in order to ensure compliance with specific laws (i.e. the Coffee Agreement as described in attachment I). Related to the fulfillment of the Law for the Conservation of Wildlife (article 132), as explained in Attachment II, industries may come forth with Voluntary Plans showing that actions are going to be taken within the facility in order to reduce or treat waste water. Unfortunately, the concept of *reducing waste waters* was not included in the above mentioned law, but has been added as an option just recently. However, to date no decree has been published to confirm this.

Little inter-institutional cooperation has taken place in the past to improve the design and implementation of regulations. However, through the execution of the present UNIDO/SID project, an initiative has emerged between MIRENEM, MINSAL and the Chamber of Industries to amend the Law for the Conservation of Wildlife in favor of a more gradual and sustainable implementation path.

Unfortunately, the opinions or conditions of the nation's industrial base are rarely taken into account as inputs for defining specific regulations, although such participation might ease their implementation. Not surprisingly perhaps, there is a widespread feeling that environmental legislation for industry is not implemented effectively.

Some general laws are not yet complemented with a more specific by-law. Furthermore, some regulations do not clearly specify the entity which will be in charge of its implementation. The result may be that either too many organizations or none assume a role in its implementation. Problems also arise when environmental regulations do not specify the penalties for violations.

1.5. Sustainable Development Initiatives in Costa Rica

In recent years, Sustainable Development has become an issue of ever increasing importance in Costa Rica. Not only is the population concerned about the deteriorating state of the environment, but there is a strong feeling that the abundant natural resources, if managed in a sustainable manner, will give the country a lasting competitive edge.

The country's efforts in the area of Sustainable Development initiated with the formulation of the National Conservation Strategy for Sustainable Development (ECODES) in 1990. ECODES was developed under the Ministry of Natural Resources, Energy and Mines during the administration of Dr. Oscar Arias. It started as a conservation strategy but was greatly enlarged in both methodology and scope. This strategy integrates many of the sectors typically found in national 21st century studies, including economics, urbanization, agriculture, water resources, demography, industry, mining, tourism, energy, and science and technology. In the program, sustainable development is seen not just as an integration of environment and economics but as the search for a way of life based on individual and group responsibility, social justice, and peaceful civil and international relations.

The present administration of President José María Figueres Olsen has declared sustainable development as its top priority (to the point that the country as a whole is billed as a global pilot project for sustainable development) and intends to build upon the spirit and principles of ECODES to produce a comprehensive and detailed sustainable development strategy. A National Environmental Action Plan is being formulated, based on the Plan of Action of Agenda 21, in which eight programs will be designed around the following issues:

1. Proper valuation of the natural resources of the country;
2. Modern management of the system of conservation areas;
3. Incentives for clean production;
4. Pollution control;
5. Promotion of alternative sources of energy;
6. Spatial planning;
7. Education and community participation in the area of sustainable development;
8. Institutional strengthening for sustainable development.

The focuses on incentives for clean production as well as pollution control reveal a strong interest on the part of the government in Sustainable Industrial Development. The present project will be a strong boost for the government to come to concrete action in these fields, as well as in other related areas such as environmental education and institutional strengthening. The project results will feed into state efforts through the National Council for Sustainable Development.

In the current National Development Plan of Costa Rica, some general ideas are presented for incentives for clean production. It is announced that various political instruments will be used in order to move away from wasteful and contaminating uses of natural resources to the benefit of clean and more efficient production.

Mechanisms will be designed to attract foreign investments from the world's leading enterprises in environmental responsibility, in order to promote local investments in environmentally sustainable projects which will contribute to the global strategy laid out in this field. Technical cooperation schemes will be developed in order to give an impulse to clean production through transfer of technology.

On top of this, a System for Environmental Certification will be designed (green seals) in order for national and international consumers to be able to distinguish products and services provided through clean technologies from regular ones. This is expected to bring about an awareness among Costa Rican consumers on the benefits of clean production and the costs associated with it. In this respect, three priority sectors have been selected for their economic significance and their environmental impact: tourism; agro industry (especially those activities which are related to the main agricultural products); and the manufacturing industry.

It is observed that no restructuring process will be viable and sustainable in the long run if the workers involved do not receive proper training in order to assimilate the changes. Therefore, training programs in the field of clean technology will be promoted, and

environmental factors will be included in general training programs on industrial restructuring.

Lastly, the National Development Plan announces that support will be given to the implementation of voluntary codes of environmental ethics.

In collaboration with the World Bank and UNDP/Capacity 21, work is presently in progress on an assessment of the environmental priorities of Costa Rica for the years ahead. Besides from a technical assessment which will be finished by the end of November, a public consultation will be held which is expected to yield results by February 1995. Again the Government of Costa Rica sees the current formulation of a coherent set of policy options for a specific sector in industry as an important input to determine the future priorities of the countries in the field of sustainable development.

As for the role of the private sector itself in the pursuit of a more sustainable form of industrialization, there is a tendency to consider the environment no longer as a threat to competitiveness but rather as an additional factor to be taken into account (similarly to quality issues in the recent past) and, at best, as an opportunity to stay ahead of competition. The best illustration of this tendency, although it mainly reflects the position of the medium and big industries, may well be the opinion of the Chamber of Industries of Costa Rica (CICR) on the introduction of SID. The Chamber identifies the need for a two-pronged approach; that is, restructuring governmental institutions in charge of issues concerning industry and environment; while at the same time creating an appropriate climate for industry to adhere to environmental policies. In practical terms, the following points are being stressed:

- A single regulatory agency should be established, to be in charge of all matters related to the environment and natural resources utilization. In this context, the Chamber signals an urgent need for uniform and harmonized environmental policies.
- Standards and regulations should be implemented in a gradual manner.
- The participation of the private sector in the design of standards and regulations will have to be broadened.
- A system of incentives should be created for those industries willing to implement environmentally sound technologies, and appropriate financing mechanisms will have to be set up.
- Environmental education for the public and private sectors should be strengthened at all levels.

The Chamber of Industries recognizes its important role in the introduction of sustainable industrial development, insisting at the same time that changes be implemented gradually and with the full participation of the private sector. The present project for the formulation of policy recommendations for SID has been recognized by the Chamber as a valuable contribution to this process.

1.6. Report contents

Following a brief introduction to explain the assignment and its background, the main body of the report focuses on sustainable industrial development policies as follows:

- Methodology**, which describes the approach used by the SID team for selecting the case study and for identifying sustainable industrial development policies.
- Policy options and assessment**. This section refers to the options available for the introduction of the sustainable development dimension into industrial development, and an assessment of their viability.
- Policy recommendations**. The proposed SID policies and their implementation path, resources required and a feasibility assessment are presented.

The main body of the report is supplemented by a number of attachments in relation to policies, agreements and lines of action for sustainable industrial development in Costa Rica.

2. METHODOLOGY

2.1. Approach

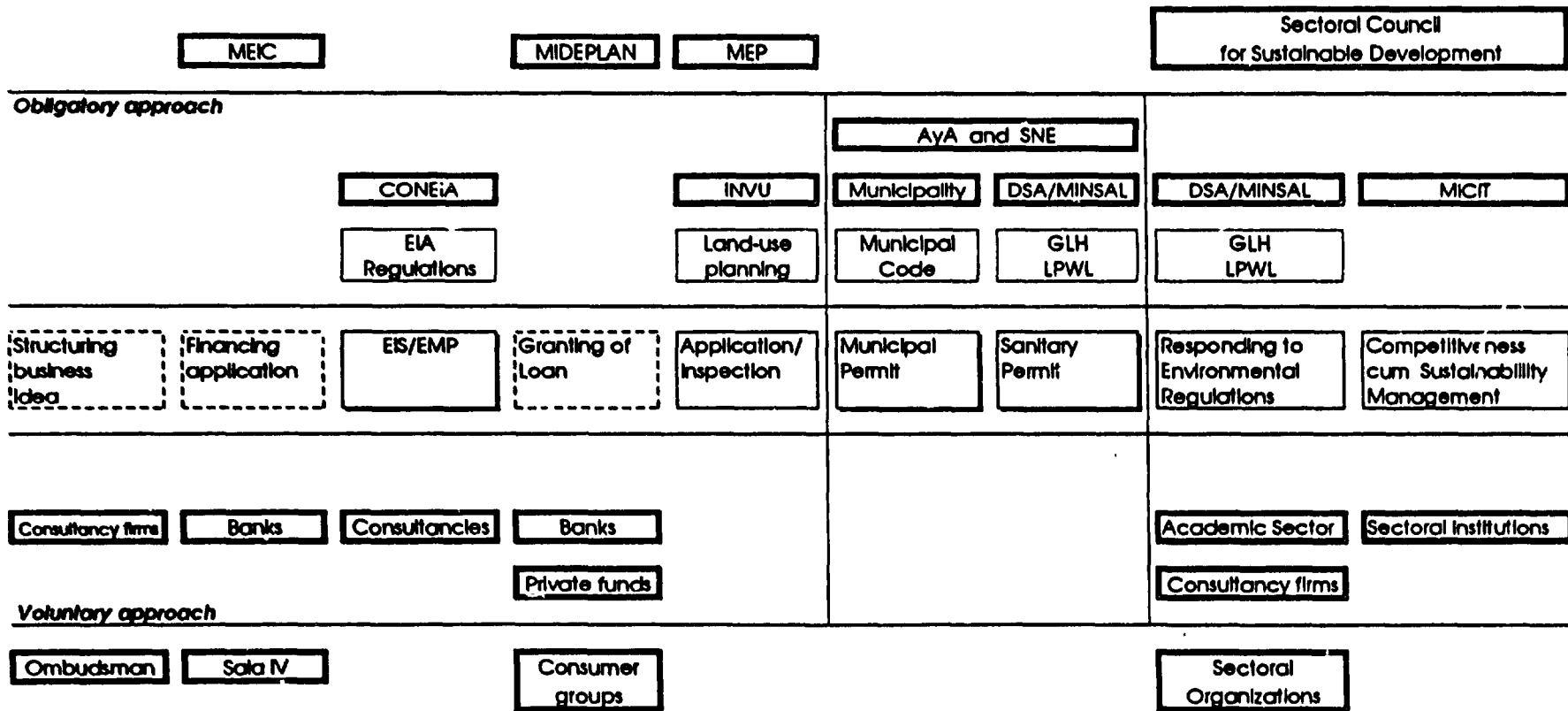
In order to arrive at policy options which would truly be supported, or, better still, brought up by representatives of industry itself, the starting point chosen by the SID team was the institutional interaction on environmental matters of an industry throughout its life cycle. Figure 1 offers an impression of this process, and will serve as a guide for the explanation of the approach followed. At first glance, it is striking to see exactly how many state institutions are involved in the enforcement of environmental regulations in industry. As a reaction to this situation, certain governmental and industrial circles are advocating the establishment of a National Commission for the Environment (CONAMA) which would act as the Environmental Protection Agency of Costa Rica.

In the horizontal center band of Figure 1, the different phases of the life cycle of an industry are depicted. On the left the industry is still in the planning stage; in the center part it is obtaining the necessary permits; whereas on the right it has reached the stage of actual operation. The area above the center band describes the mostly obligatory role of the different governmental and municipal agencies; those immediately adjacent to the center band having a direct interaction with the company, whereas the ones that are further above have a more indirect effect on the environmental performance of the company.

As far as the governmental and municipal involvement goes, the industry will be interacting directly with:

- The Commission for Environmental Impact Assessment CONEIA (only for certain cases - see for a more detailed discussion section 4.1.2.);
- The National Institute for Housing and Urbanization (INVU) which is in charge of land use planning;
- The authorities of the municipality in which the company wishes to settle. From the municipality the industry will have to obtain the municipal permit.

Figure 1.
Institutional Interaction on Environmental Matters
in Various Phases of an Industry's Lifecycle



- The Department of Environmental Sanitation (DSA) of the Ministry of Public Health. Here the company will have to apply for a sanitary permit, which has to be renewed every year. The decision on whether to renew the permit is based on the provisions of the General Law of Health (GLH) and the Law for the Protection of Wildlife (LPWL).
- The utility companies AyA and SNE, for a connection to the water and electricity grid, respectively.

More from a distance, the following state institutions have an influence on setting the stage for the interaction of industry and the environment:

- The Ministry of Economy, Industry and Commerce (MEIC), through its Directorate General for Industries.
- The Ministry of Planning (MIDEPLAN), in charge of, among other responsibilities, drawing up the National Development Plans.
- The Ministry of Public Education (MEP), which (co)determines the curricula of all school types and levels except the universities.
- The Sectoral Council for Sustainable Development, which is in charge of drafting specific plans for the implementation of the concept of sustainable development in Costa Rica.

The area below the horizontal center band describes the private sector entities which (may) interact with a company seeking to fulfill its environmental objectives. The organizations with which the industry will have a direct interaction are the following:

- Consultancy firms offering help in the formulation of a "bankable" business plan. It should be noted in this respect that it is as yet very uncommon that an industry at this stage teams up with a consultancy company to formulate a business plan.
- Banks or private funds. More and more, financing institutions are starting to introduce environmental considerations in their evaluations of loan applications.
- Consultancy companies specialized in Environmental Impact Evaluations (if required)
- Consultancy firms, academic institutions and sectoral institutions in the stage of the actual operation of the company.

More from a distance, the following organizations may also have an impact:

- The Costa Rican version of the "Ombudsman", mostly in moments of conflicts on environmental issues, e.g. between the plant and the surrounding community.
- The "Sala IV" or High Court of Costa Rica.
- Consumer groups which are only hesitantly emerging in the country.

The approach of the SID team has been to consult intensively with representatives of virtually all organizations listed in Figure 1, with a special focus on industry itself. In Attachment III a list is included of the contacts established in the course of the project. The results of the consultations, combined with the experience of the team members in the

implementation of the concept of SID, became the foundation for the SID policy menu which is to be presented in chapter 3.

2.2. Selection of the food sector and case studies

The purpose of selecting a specific industrial sub-sector for study in connection with the SID policy development effort was to enable the project team to gain a realistic understanding of the SID challenges facing Costa Rican industries today. Industrial sub-sectors considered for special study included agro industries (coffee, sugar, banana), food processing, chemicals (chemicals, plastics, pharmaceuticals, rubber), leather (tanning), metal mechanics, and textiles (dyeing). Selected characteristics for each of these six industrial sub-sectors were evaluated with respect to their relevance to and impact upon the SID project's objectives. The food processing sub-sector (excluding beverages and tobacco products) was ultimately chosen, partially as a result of a comparative analysis of sub sectoral industrial indices as presented in Attachment IV. Additional criteria evaluated on a more qualitative level are presented in Attachment V. Consultations with knowledgeable government and industry representatives in early September confirmed the selection of this sub-sector. Some characteristics of the food processing sector include:

- a relatively large number of enterprises are engaged in food processing;
- the total added value is the highest among the different industrial sub sectors;
- the sector employs a relatively high amount of people;
- enterprises participate in domestic and export markets (and compete domestically with imports); and
- its function as a provider of food stuffs is critical to sustainability.

Many of these characteristics can be claimed by the coffee processing sub-sector as well. However, a lot of investigation is already going on to reduce waste generation in that sector and the efforts have been formalized by a signed agreement for such between government and industry representatives.

As a preparation to the company visits, a visit protocol was developed to help guide the evaluations of SID-relevant conditions at each of the industrial enterprises. Attachment VI presents the protocol used. Visits to 14 representative food processing industrial facilities were conducted in September of 1994. The facilities were chosen to represent a diversity of:

- sizes (between 80 and 2,100 staff);
- ownership (family, corporation, international);
- markets (domestic and export, with or without import competition in Costa Rica); and
- product types: dairy, fruit, vegetable, meat/poultry/fish, grain, and confectionery.

Visits lasted between one and one-half and five hours. The focus of the evaluations was on how materials were used at the facility. Facility tours were part of every visit to permit first-hand observations of materials handling and use. Managers were consulted for opinions about the environmental challenges and problems they must confront. Without

exception, the SID team found enterprise representatives to be generous with their time for the visits and forthcoming with the information requested. Attachment VII contains detailed profiles of all plants visited, whereas more generalized conclusions on the diagnosis will be presented in section 2.3.

2.3. Diagnosis of the food processing industry in Costa Rica

2.3.1. Overview of food processing enterprises

During the company visits, several issues of primary concern to environmental sustainability (e.g., resource use efficiency, waste generation and management) were noted:

- water use methods and activities;
- organic solid waste management; and
- product packaging.

Of the three issues noted above, it is interesting to note that only that of water use is fully within the control of the individual enterprises. The other two require the involvement of services or activities (e.g., municipal recycling) external to facility-specific food processing. Post-consumer packaging recycling is probably the furthest removed from the control of individual enterprises (although options for food processors' contributions to improving the existing situation are discussed in Section 4.2).

Secondary issues include, but are not limited to:

- energy use for cooking and cooling/refrigeration;
- fleet vehicle maintenance;
- flooring;
- packaging of incoming materials;
- noise; and
- the use of chlorine.

Further discussion of these issues follows. Options for remedying non-sustainable aspects of these conditions are presented in Section 4.2.

2.3.2. Water use methods and activities

Water is not only a valuable resource as an ingredient in food products, but it also serves other valuable functions within industrial facilities. Its use is entirely within the control of an enterprise but facilities are typically not designed for its use to be efficient. Thus, when process changes for efficiency improvements are being contemplated, it can be difficult to change a facility accordingly (e.g., through repiping). Also, worker habits are not readily changed to reduced water use. Intensive water use in cleaning and other functions may be viewed as necessary for high quality and labor savings. In that case, it will have to be proved that water conservation does not jeopardize product quality.

In the food processing facilities visited, water is primarily used for cleaning and materials transport. Other uses include: cooking, cooling (including ice production), and mixing into products.

Standard cleaning patterns include the following:

- Container washing is done with one or more fillings of water, possibly with:
 - ♦ the addition of a cleaning/disinfecting agent;
 - ♦ hot water and cooking; and
 - ♦ mechanical scrubbing (although relatively infrequently practiced in the facilities visited).
- Hoses are used to transport water to cleaning sites for floors and equipment:
 - ♦ flow rates per hose ranged from a low of approximately 2 liters per minute to full force flows from hoses 4 centimeters in diameter;
 - ♦ the majority of facilities did not use a flow control device at the end of the hose, and, since the hose valve can be located some distance from the cleaning site, water ran from the hoses, even when not in use; and
 - ♦ the water pressure was often low so that cleaning effectiveness had to be achieved with high volumes of use.
- Equipment and floors are washed down one or more times per day. The wash down waters are captured in trenches or drains, which flow to a common waste water treatment system or discharge point. Older facilities in particular suffer from irregular floor surfaces which are not easily washed and/or do not drain or dry well, thereby requiring greater water use and creating employee safety hazards.
- Waste waters from various sources are mingled:
 - ♦ flooring, drains, etc. are not designed to keep different types of waste waters separate;
 - ♦ processes may be intertwined on the facility floor making waste water segregation difficult; and
 - ♦ a waste water treatment plant may have been sized to handle the facility's total, dilute waste water volume.
- Only a few facilities collected high quality waste waters from one process in the facility for use in a less demanding process (e.g., floor cleaning or waste transport) elsewhere in the facility.

The use of water to carry materials from one process to another or to transport wastes away from a process is common in the food processing facilities visited. Large volumes and high flow rates must be used to transport the materials washed from the floors through to the discharge point: to prevent clogging, to have enough force to move particles, etc.

2.3.3. Organic solid waste management

An advantage of food processing industries is that the wastes generated are generally non-toxic and non-hazardous. The wastes consist primarily of residues such as fruit and vegetable skins and pits, stems and stalks, bones and feathers, etc. from input foodstuffs which have undergone processing. Because these residues are not fit for human consumption whereas the plants where they originate are largely devoted to production of food products for humans, the residues are often not usable on-site.

Only some enterprises have found ways to reuse organic solid wastes. Typically, the reuse option applied is for animal feed. The greatest rate of reuse is made by enterprises which have vertically integrated facilities:

- cattle slaughterhouses for meat production for human consumption which also have soap factories to use tallow wastes;
- poultry processors producing chicken feed from all slaughterhouse waste to sell back to the farmers supplying the chickens; and
- one fruit processor having close ties to fruit suppliers whereby fruit waste is returned to farmers via the same processor-owned truck making fresh fruit pickups.

The irregularity with which reuse of organic solid wastes is taking place highlights several conditions: many processors, and particularly very small generators of waste, are unable to establish the connections with potential buyers so that waste by-products may be sold off as products. Motivation to locate potential buyers is not provided by disposal costs, which are relatively low at present.

2.3.4. Product packaging

Plastic packaging pervades the food industry. It has come to be expected by many consumers due to its association with hygiene, food quality protection (e.g., from humidity), convenience of storage and use, light weight, and aesthetics. Industry's use of packaging is basically in response to customer demands and the desire to compare at least equally with competitor's products; Costa Rican produced foodstuffs may face competition in and from both import and export markets. Redundant packaging such as individual wrapping within a larger package, double wrapping, etc., signifies an additional cost for the food processor but again may be the expectation of the consumer for convenience and food protection.

Post-consumer packaging waste is generated when the final consumer has finished with the product and discards the waste to the municipal solid waste stream. But plastic packaging waste is also generated at production facilities by:

- emptied containers from raw material inputs;
- packaging equipment malfunctions;
- plastic used for intermediate product storage and movement within the facility; and
- unsold inventory.

Only very few of the enterprises visited were using refillable, more durable plastic containers for storage and/or packing of intermediate and final products. Also, few enterprises sent waste plastic to recyclers. For post-consumer plastic wastes:

- there are some grassroots efforts to encourage voluntary recycling, and
- one large and financially secure food processor is initiating a pilot program to collect its specific type of plastic packaging from consumers.

2.3.5. Other issues

During the visits to food processing facilities, the UNIDO SID team noted other issues to be present at more than one facility. These broad observations are briefly summarized below. They warrant further examination.

Energy use for cooking and refrigeration

Energy efficiency in cooking processes appeared very variable. The diversity of equipment (ovens, kettles) and the age of equipment would necessitate measurements and evaluations by experts on energy systems. The same holds true for refrigeration systems. However, some common and apparent inefficiencies in the way refrigeration systems were used were noted:

- doors were left open even when a refrigeration compartment was not in use;
- seals around openings were not complete, often due to ice build-up or the placement of objects preventing closure of doors;
- movement of materials into and out of refrigerated storage was not always accomplished in an energy conserving manner because: openings were larger than necessary, materials were moved in small batches rather than in bulk, and the timing of refrigeration needs was not coordinated so as to take place at once;
- temperatures should be maintained at levels appropriate to the task, not lower.

Fleet vehicle maintenance

Trucks used to distribute final products were sometimes owned by the food processing enterprise. For those enterprises which maintain their own vehicles, issues of waste generation become important:

- oils drained from vehicles might be dumped to the ground or alternatively be reused as fuel supplements or filtered and reused in less demanding lubrication applications;
- other fluids (e.g., brake fluid) and replaced parts (e.g., filters, belts) are problems for disposal, largely because the mechanisms for their sustainable management have not been well established in Costa Rica (e.g., reusable filters, recycled air conditioning system fluids);
- tires currently have no particular recycling outlet in Costa Rica, and although relatively benign in the environment, they are unsightly, consume much landfill space, and, if burned in an uncontrolled manner, can result in serious air pollution.

Flooring

Floor characteristics affecting the ease with which they are cleaned include:

- smoothness;
- slope, for drainage; and
- trench and drain placement.

Many of the facilities visited had rough, concrete floors, thereby promoting the collection of materials in the irregularities. Smoother floors might be more easily swept first rather than relying on water only for cleaning. Trenches and drains were often distant from the process being served by them. For example, in one dairy facility, fluids from the cheese tank were drained directly onto the floor beneath the tank. It was then necessary to use significant quantities of water to move all the drained materials across several meters of flooring into a trench. Once in the flat-bottomed trench, additional water was used to cause the materials to flow out to the waste water treatment plant.

Packaging of incoming materials

Some raw materials supplied to the facilities were found to be packaged in a variety of containers of different materials. To use the materials in production, they are unpacked and the packaging is typically discarded. These materials then represent a solid waste disposal cost for the enterprise. Alternatively, the enterprises may seek to:

- reuse the packaging for their final products;
- send the packaging back to the supplier for refill;
- provide the packaging to another industry;
- send the packaging to a recycler rather than a landfill;
- burn the packaging for its fuel value (assuming proper emissions controls are provided); and/or
- request that raw materials suppliers minimize the packaging used and/or change to packaging that is more easily reused or recycled.

Noise

Processing equipment in many facilities is noisy. Hearing protection was worn by very few employees. In those facilities where it was noted, the usage among employees was very sporadic suggesting that the hearing protection was made available by the enterprise's management but that employees chose not to wear it. In only one facility was it noted to be worn consistently, probably due to a policy mandating its use. It is recommended that in all facilities where noise levels are high, the enterprise at least makes available hearing protection devices and educates the employees about the use and benefits of ear plugs, headsets, etc.

Chlorine use

Although a widely used chemical for cleaning and disinfection purposes, chlorine is undergoing environmental review in numerous venues around the world. For instance,

Norway is considering banning all use of chlorine. Food industries visited added chlorine to wash waters for both incoming products (e.g., to clean the skins of fruits intended for processing) and for equipment (e.g., cleaning between batches for bacterial control). Thus, chlorine serves a critical function. But its use may especially be a problem in the food processing industry due to the potential for dioxins formation. Dioxins are believed to be among the most toxic chemical groups known; they may form when chlorine is in the presence of organic materials --obviously present for food processors -- and the combination is exposed to heat (e.g., cooking process waste streams, aeration lagoons exposed to the sun, etc.).

Investigations into alternative disinfectants, more precisely controlled use of chlorine (e.g., lowered concentrations or lowered volume of use through water conservation efforts), or new technologies such as ozonation are warranted. Universities and consultants may assist with this Research and Development effort.

2.4. Meeting with the Select Group

As an integral part of the SID team strategy, a three hour meeting was held on November 17 with a small select group of 10 representatives from industry, the academic sector and the government, in order to present the general menu of policies for Sustainable Development. It was found that in general, the project team and the participants coincided on the route to be followed towards the implementation of SID.

2.5. One day seminar on "Sustainable Industrial Development in Costa Rica"

On December 7, 1994, a one day closing seminar entitled "Sustainable Industrial Development in Costa Rica" was held, attended by 59 representatives from Governmental and municipal agencies, industry, the academic sector, NGO's and donor organizations. The seminar was organized in cooperation with the Sectoral Council for Sustainable Development, the Chamber of Industries of Costa Rica and the Chamber of Food Processing Industries. The Coca Cola Interamerican Corporation acted as the co sponsor of the event. Speakers included, apart from all members of the SID team, the Vice Minister of Science and Technology Mr. Eduardo Sibaja, the Coordinator of the Commission for Environmental Issues of the Chamber of Industries Mr. Luis Fernando Arce, the manager of the plastics recycling company RECYCO Mr. Sergio Goñi, and the Director of the Sectoral Commission for Sustainable Development Mr. Alejandro Esquivel. In Attachment VIII the program of the event as well as a participants list can be found.

3. POLICY OPTIONS AND ASSESSMENT

3.1. Introduction to the policy framework for SID

3.1.1. Underlying principles

Fundamental principles of sustainable development include:

- Sustainability must integrate aspects of Costa Rica's ecological, social, financial, and technological circumstances and goals.
- Responsibility and equity are to be maintained or enhanced for enduring sustainability.

For sustainable *industrial* development (SID) in particular, the following basic principles serve as guidelines to policies developed in the remainder of this section:

1. Industrial sustainability and competitiveness are promoted in parallel.
2. Reduction, reutilization, recycling, treatment and final disposition (disposal) is the order in which wastes and emissions should be handled.
3. Efficient use of resources can result in significant cost savings and improved competitiveness.
4. "The polluter pays": Those who are responsible for environmental damage should pay for compensation or restoration.
5. Short and long-term realities require an incremental management plan.
6. An emphasis is placed on dialog and cooperation between government and private sectors.
7. Society (i.e., the public, the citizenry) has a responsibility to support and participate in sustainable industrial development.

A menu of policy options that can motivate and support technical changes necessary to realize the SID goals listed above is presented at the end of this section. Section 3.2 describes salient features of the range of options and identifies which of the options are recommended for implementation in Costa Rica. Recommended options are elaborated upon in Section 4.1.

The remainder of this introductory section examines:

- why industry does not currently behave in a sustainable way;
- what mix of required and voluntary measures is appropriate to guide industry to sustainable behavior; and
- what are the technical capabilities and limitations, preferences and desires for sustainable industrial operations.

3.1.2. Why is industry currently not sustainable?

Resources appeared abundant, non-depletable, pollution emissions and their effects on human health and the environment were not well understood for some time. But now it is apparent that current industrial activities in Costa Rica are not sustainable. The reason

that this condition is more readily recognized is because negative impacts of unsustainable industrial behavior are becoming serious constraints to other aspects of the society. Growing awareness of the environmental impacts of our modern existence is unfortunately prompted by the critical proportions of environmental degradation being experienced, several of which include:

- access to clean river water is not possible in the Central Valley;
- residential neighborhoods have grown up around industrial facilities once located in the countryside and pollution emissions no longer go unnoticed;
- more and more non-biodegradable products are produced which require disposal at the ends of their useful lives, thus consuming land for dumps; and
- as more people need more transportation, the assimilative capacity of the atmosphere is declining.

Consumption of natural resources is also taking place in an unsustainable manner. However, industry must use resources to produce the products or services demanded by other industries and the public. Neither industry's nor the public's behaviors in the marketplace are based on an evaluation of the availability of natural resources to Costa Rica. And sustainability is very much a question of how efficiently natural resources are used. Much of industry's actions are instead based on the costs of doing business; in other words, can revenues cover expenses? Information and tools to allow adequate measurement of real or full costs of resources are not yet comprehensive. Nor are the full costs borne by those involved in the industrial marketplace. Thus, behavior does not reflect assumption of responsibility for environmental damage and inefficient resource use.

First, the government must ask what is sustainable and efficient for the country of Costa Rica as a whole? What resources are available and how are they best used? Which unsustainability problems should be addressed first and why? Assuming that government can influence the broad matters of sustainability, then industry will ask similar questions but on a micro scale.

Attachment IX presents a discussion of how government and industry might address the challenges of sustainability planning through information collection, measurement and prioritization of problems, and selection of techniques and technologies to begin to remedy the problems of environmental degradation and unsustainability.

3.1.3. What balance is sought between obligatory and voluntary measures?

As depicted on the diagram of Figure 1, the life cycle of a Costa Rican industrial operation is influenced by a variety of forces, some to which it is required to respond ("Obligatory Approach") and others for which alternate behavior is optional ("Voluntary Approach"). Government must intervene in industry's life cycle when resource inefficiencies, environmental and human health harm, and threats to sustainability are not being addressed by the voluntary forces. This is demonstrated by the regulatory requirement for waste water treatment or process change to reduce waste water discharges which had to be developed by MIRENEM to address the lack of incentives (e.g., penalties) for industries to reduce their pollution of water bodies. Government's role is largely one of

protecting country-wide interests and those interests that are not organized to have a voice in the marketplace or other influences on voluntary approaches (e.g., a small segment of the population drawing drinking water from a contaminated river).

Since industry is changing its perception of its role to sustainability, not all of the inefficiencies currently existing will need to be remedied by new government regulations. Moreover:

- inefficiencies leading to waste are also equated with unnecessary losses of valuable resources used in manufacturing;
- waste leads to contamination of the environment; and
- financially, wastefulness leads to weakened competitiveness.

Ideally, the marketplace for goods and services would have environmental and sustainability concerns reflected adequately in resource use pricing. Although advancements are being made in this regard, full market representation is unlikely to exist for a long time. Thus, the policies developed and presented later in this section are a mixture of obligatory and voluntary measures. Obligatory measures continue to force necessary adjustments. Voluntary policies seek to broaden the SID awareness of industrialists to help them to make better informed decisions about the sustainability of their enterprises.

3.1.4. What techniques and technologies will achieve SID?

The classical and preferred hierarchy for SID realization is:

- proper selection of resources to use for providing goods and services;
- reduction of materials used and wastes generated, through resource use efficiency and clean technology;
- reuse and recycling of waste that cannot be avoided, reuse/recycle either inside or outside the facility; and
- safe treatment and disposal of wastes which cannot be avoided and for which no use can be found.

These techniques and technologies are briefly discussed in Attachment IX and X. Many documents published worldwide can provide greater detail on these subjects.

In Attachment XI, a preliminary, low-cost, low-technology SID technique for the food processing industrial sub-sector in particular is identified. Future projects may elaborate upon the details needed to implement this idea within the food processing sub-sector.

3.1.5. Menu of policy options for SID

Table 1 below shows the policy menu for Sustainable Industrial Development as identified by the UNIDO SID project team. The priority options which will be developed in chapter 4 have been printed in italics.

Criteria for selection and ordering of policy options are described in Annex to Section 3.1. (Attachment XIII)

Table 1. Policy menu for Sustainable Industrial Development in Costa Rica

INSTITUTIONAL POLICIES	MANAGEMENT POLICIES	FINANCIAL AND ECONOMIC POLICIES
<i>Strengthening MINSAL</i>	<i>Strengthening of consultancy capacity</i>	<i>Soft credits and subsidies</i>
<i>Strengthening of the EIA Commission</i>	<i>Voluntary Environmental Code of Conduct</i>	<i>Resource pricing adjustments</i>
<i>Inter-institutional coordination and cooperation</i>	<i>Programs on energy and water use reduction</i>	<i>Import tariffs with sustainability criteria</i>
<i>Strengthening municipalities</i>	<i>Waste management</i>	<i>Tax incentives for pollution prevention/control</i>
<i>Strengthening academic and research institutions</i>	<i>Eco-friendly product certification (Eco-Labeling)</i>	<i>Bans and penalties</i>
	<i>Recognition of outstanding SID achievements</i>	
	<i>Creation of clean technology enterprises</i>	
	<i>Compliance with standards in the country of origin</i>	

3.2. Description and assessment of policy options

A viable industrial base is a requirement for the development of any country and, in Costa Rica, it has gradually become a prime source of goods, services, employment and national wealth. However, industrial activities, including mining, are directly responsible for much of the pollution and resource depletion that affect the country's environment.

Fortunately, there has been a distinct heightening of environmental awareness among industries in Costa Rica, which has been coupled with a government focus on sustainability. In some cases, this new regard for the environment does not extend much beyond looking green or responding to the current environmental regulations. But for an increasing number of industries, as yet mostly multinational enterprises, reducing the environmental impact of the use of natural resources and the disposal of wastes is a matter of strategic importance. In fact, for some of these companies, environmental stewardship has become a business opportunity rather than simply an expensive burden -a chance to improve both company image and production efficiency at the same time, with increased competitiveness as a result.

The ESID team has identified a number of policies that would be applicable to the Costa Rican situation. These policies were prioritized according to sustainability criteria, focusing on pollution prevention and resource efficiency.

This section describes policy options for sustainable industrial development, as considered in government and sectoral strategies and programs, and various international sources. These options have been divided into managerial, industrial and technical, financial and economic, and institutional policies as follows.

3.2.1. Institutional policies

The successful application of sustainable development policies require improvements in the institutional framework of the country. This section focuses on the strengthening of competent and permitting authorities and support institutions involved in environmental management.

3.2.1.1. Strengthening MINSAL

The strengthening of MINSAL will focus on strengthening the Ministry's emphasis on prevention within a multi-media approach. It would include the up-dating of regulations and procedures for the National Health Law and the Law for the Conservation of Wildlife; developing of an information system and a documentation center; improving the status of the Division of Environmental Sanitation; and strengthening MINSAL's laboratory capabilities. A full description of this policy is provided in the next chapter.

3.2.1.2. Strengthening of the EIA Commission

MIRENEM's Decree No. 23790, which was signed on 28 October 1994 requires proponent of projects which may produce significant damage to the environment to undertake an environmental impact study. The decree also establishes the National Commission for Environmental Impact Assessments, whose functions are to screen projects for the EIA procedure, analyze, evaluate and approve, as appropriate the studies and monitor the implementation of measures proposed in the study.

The mandate of the EIA Commission covers a wider range of projects, but at present it has serious limitations in its capacity to deal with the large of number of projects that are introduced into the EIA procedure. The SID team proposes a policy for the strengthening of CONEIA as described further below.

3.2.1.3. Inter-institutional coordination and cooperation

There have been a number of motions, from both the government and the industrial sector, to set up a National Commission for the Environment (CONAMA). The proposed role of CONAMA was to coordinate the activities of all the institutions involved in environmental protection and to enforce the environmental law. Such proposal was first made by the team which formulated the National Sustainable Development Strategy (ECODES) in 1990, and was recently revisited by CICR in its document "Towards an Industrial Policy for the XXI Century".

Although inter-institutional coordination and cooperation is essential for ensuring sustainable industrial development, setting up an independent agency such as CONAMA does not guarantee success. Instead, much could be achieved without involving a new organization, by rationalizing the environmental legislation, clearly defining each agency's responsibilities for both the development of regulations and standards and their enforcement.

In addition, an encouraging degree of inter-institutional coordination has already been achieved by the current administration through agreements between government, sectoral and service institutions, for pollution prevention and control. A good example of this is the agreement signed by the government (MINSAL, AyA and SNE) and ICAFE, on behalf of

the coffee producers, which defines specific pollution reduction targets and suggests means for achieving them.

Although there seems to be some emphasis on pollution control for the achievement of these goals, the coffee agreement provides an excellent opportunity for the development of pollution prevention and energy efficient measures. These measures could then be applied to this and other agreements that may be signed in the future.

3.2.1.4. Strengthening municipalities

Municipal Permits are an essential requirement for an industry to begin the construction of a new installation. Municipalities are required by law to consider the results of an EIA to issue a permit for a new installation. An EIA is required for certain industrial development prior to granting a Municipal Permit.

A mechanism for negotiation and mediation would be useful to ensure that the final decision regarding a new plant is both environmentally sustainable and equitable. The intervention of the People's Ombudsman (Defensoría de los Habitantes) would be very valuable when mediation is required.

Undoubtedly, the area with the highest concentration of industry, and pollution, in the country is the Greater Metropolitan Area of San José (GAM), and it is this area which has received greatest attention regarding environmental control. For instance, the Inter-American Development Bank is financing a project to support the development of land-use planning capabilities in the GAM, with a focus on environmental protection. The project, which is being carried out by a private consortium with MINSAL as counterpart, includes the development of a number of policies for pollution prevention and control, and mechanisms for their implementation including the involvement of municipalities. An interesting aspect of the GAM project is the use of contingent valuation to assess the willingness of the public and private sectors to cover the cost of implementing the proposed policies

Municipalities require strengthening their capabilities for zoning and land-use planning, with the objective, among others, to ensure that industries are sited in areas where there is sufficient availability of resources, appropriate communications and that there is no conflict with other land uses in the area. Environmentally compatible zoning would also provide the framework for the environmental assessment of new industrial developments in a given zone. Municipalities should also be able to review and make a decision for granting Installation Permits as per the results of EIAs of new industrial developments.

3.2.1.5. Strengthening academic and research institutions

Academic and research institutions have a very important role to play in the development of SID technologies. At present, the most important academic and research institutions in the country, the University of Costa Rica and the National University, have some involvement in research and development work for clean and resource-efficient technologies.

However, they are practically the only institutions with laboratory capabilities to respond to the need for environmental monitoring, and therefore have great demand, from industry

and government alike, for analyses in relation to water quality control. Universities also provide consultancy services in EIA and pollution control .

Although the laboratory and consultancy services provided by universities are essential at present, academic institutions require support to gradually phase out these activities in order to concentrate in research and development. For this to happen, professionals in the field should also realize the business opportunity of setting up laboratories and expand their consultancy services to include pollution prevention and resource-efficient solutions to industries.

The Technological Institute of Cartago (ITCR), is undertaking R&D work for the logging industry, which may lead to the sustainable exploitation wood. Other institutions such as CICAPE, for the coffee sub-sector, and DIECA for the sugar industry, provide research services regarding waste management and laboratory support to their members.

3.2.2. Management policies

The managerial policies discussed below include: strengthening of consulting capacity on EIA and pollution prevention, regional environmental quality management, sectoral cooperation, voluntary codes of conduct, certification of green products, and recognition to SID performance.

3.2.2.1. Strengthening of consultancy capacity

This package of policies is described in greater detail in the next chapter.

Introduction

Consulting services are a means for distributing (and implementing projects based upon) specialized information to the industrial community and thus are critical to the support of the resource use efficiency, pollution prevention, and reuse/recycling policy objectives discussed in Section 3.1. For the near to mid term, a specialized service sector can facilitate the rapid application of techniques and technologies to industry's SID challenges. Furthermore, consultants are appropriate vehicles for providing corrective and/or process modernization capabilities that industry does not need on a full-time basis. Over time, perhaps all engineering disciplines can become sufficiently knowledgeable of SID goals and how to incorporate them into the initial designs of all construction, production, industrial, agricultural, transportation, waste management, operation and maintenance, etc. projects.

Environmental Impact Assessment

This policy involves strengthening consultancy companies in their capacity to respond to CONEIA's requirements for the development of procedures and guidelines and for EIS review. Consultants expertise for EIS preparation, on behalf of the project proponent would also be enhanced.

Green design and redesign

Industrial process "green" design entails incorporation of SID goals into the initial layout and operations of facilities. Product "green" design suggests that a product's materials of fabrication, impacts through use, and fate after use are environmentally sustainable. The

term "green" is used to imply that something is not detrimental to the environment or to worker or user health and safety.

For existing facilities and products, redesign for greater sustainability may be necessary. Green redesign seeks to remedy resource inefficient and waste generating process design problems. Because redesign requires modifications to equipment, processes, procedures, and products, it can be technically and financially more challenging than original design. The development of consultants able to provide green design and redesign services to industrial enterprises is crucial to SID in Costa Rica because most industries are not operating at maximum resource use efficiency and minimal waste generation at present.

As mentioned in the introduction to this policy option, the ideal situation would have SID considerations incorporated into all disciplines having bearing on the original designs of production processes and products (particularly engineering, although economics, sociology and others determine the framework within which engineering endeavors take place). For now, specialized consultants may be used to fulfill green objectives. Below, the use of audits as preparatory tools for green redesign is discussed.

Audits

An important tool for the evaluation of SID potential at an enterprise is an audit; in general, it evaluates current situations and identifies needs and opportunities for improvements. Audits can take a wide variety of forms, depending upon the specific SID objectives of an enterprise's management. The audit may be oriented to:

- the entire facility or only selected processes within it;
- modifying or completely changing existing equipment and structures;
- understanding the status of materials and energy use at the facility to: (i) compare to industry norms and (ii) identify opportunities for improvements;
- etc.

Since industrial enterprises may not need to carry out auditing on a continual basis but rather only intermittently, it may be more economical and effective for enterprises to hire specialized consultants on an "as-needed", project specific basis.

Auditing talents need to be developed to know: what to examine, what data to collect, how to evaluate it, how to supplement it if necessary, and what analyses to carry out to ensure efficient and effective contributions to SID in Costa Rica.

Training

Environmental consultancy services in Costa Rica are at present mostly focused on water pollution control, although some undertake EIA studies as well. Consultancy services should be expanded to pollution prevention, material-efficiency audits and clean technologies, and should also be able to provide training on such subjects.

Competitiveness with sustainability

One of the explicit goals of the Ministry of Science and Technology of Costa Rica is to strengthen the local capacity for consultancy support, as a means to achieve a multiple

effect of upgrading the industrial base of the country. An important step in this effort will be to make sure that, apart from strengthening private sector and university initiatives in specific areas of environmental protection in industry such as Environmental Impact Assessment and auditing, management consultancy firms incorporate environmental considerations in their services from the holistic viewpoint of sustainable development.

3.2.2.2. Voluntary Environmental Code of Conduct

All private and public sector actors in the field of environment and industry appear to agree that, in order to keep up with changing market conditions which increasingly require that products and services be provided in harmony with the environment, the implementation of a comprehensive legislative framework for SID in Costa Rica has become a matter of urgency. At the same time, however, it is recognized that law making in Costa Rica can be a lengthy process, and the introduction of a voluntary Corporate Code of Environmental Conduct has repeatedly surfaced as a potentially effective stepping stone towards a legislative framework for SID.

The primary objective of such Corporate Code of Environmental Conduct would have to be to promote sustainable and competitive entrepreneurship on a voluntary basis. The Code may be modeled along the lines of the CERES principles in the United States, or be more specific for different industrial sub sectors. An administrative agency would have to be set up, or an existing organization might be strengthened, to promote the Code in the industrial community of Costa Rica; evaluate the environmental record of enterprises; have them subscribe to the Code; monitor their environmental performance; and publish the results on a regular basis. Some important additional benefits of this process may be the following:

- ◆ The competitiveness of participating enterprises may be strengthened through the exploitation of environment-related opportunities.
- ◆ A dialogue and cooperation is expected to evolve between industry, the Government and special interest groups on a practical road towards Sustainable Industrial Development.
- ◆ A transparency on the part of the industrial community concerning its environmental performance would be promoted.

Considering the strong interest on the part of a number of forward looking industrial enterprises in Costa Rica in any kind of formal recognition of their efforts to protect the environment, the gradual introduction of a Voluntary Code of Environmental Conduct is considered quite feasible. In fact, the "*Coffee agreement*" between the coffee bean processing industry and the Government of Costa Rica may be considered a first attempt to come to an (industry specific) Voluntary Code of Environmental Conduct. Important issues to be sorted out include the question of whether the Code should be administered by a private or a public entity, and how to secure the resources for administering the Code for a prolonged period of time (as it is not considered realistic at this point that the Code could be self-sufficient on the basis of contributions from industry).

3.2.2.3. Programs on energy and water use reduction

It has become clear that some action must be taken to minimize the impact of industrial emissions on the environment. This has led to the implementation of end-of-pipe solutions which tend to be expensive and hardly effective. Industries should pursue cleaner production as the means to reduce pollutants at every stage of the production process and to increase industrial productivity.

Reducing water use leads to cost savings for industry, not only in their water bills but also potentially in terms of the cost of their waste water treatment plants. Likewise, reducing energy use leads to savings on utility and fuel bills. Therefore, implementing such reductions (which do not always require new technologies and equipment, but perhaps only changes in procedures) enables business and organizations to pursue their financial goals while improving the environment at the same time.

Electricity consumption in Costa Rica has grown at an annual rate of 6% over the last 10 years¹. This has increased the demand for fuel as a source of energy, as existing hydropower plants are not adequate to cover such growth. Concerned about this situation, the Government established a National Commission for Energy Conservation (CONACE), represented by institutions and companies in the energy sector. At the same time, a new department for Energy Conservation was created within the National Electric Power Company (CNFyL). CONACE is in charge of ratifying a recently published Law for the Rational Use of Energy. Both the CNFyL Department and the Costa Rican Institute of Electricity (ICE) are executing programs on reducing energy use. These programs are oriented to both residential and industrial clients.

As regards water use reduction, an effective and easy-to-implement program is described in Attachment XI. This program is designed for industries using hoses not presently equipped with water flow, pressure, or easy shut-off control devices.

At least one Costa Rican industry has already benefited from a similar program. This particular industry has realized savings of over six thousand dollars on its monthly water bill by implementing relatively cheap changes in its processes and procedures.

3.2.2.4. Waste management

Waste management can be achieved within an individual plant, in an industrial corridor or in a region as a whole. Waste management at a regional level provides an instrument for internalizing the costs of damaging the environment, thereby making the polluter (and ultimately the consumer) pay. The aim of the regional environmental quality management approach is to achieve a specific quality objective in a cost-effective manner.

Waste management can be undertaken for waste water, air emissions and solid waste. This approach has been used mostly for water quality through pollution prevention and, more often, treatment and disposal of waste water, within the context of a watershed or a region as a whole. There are examples of regional air quality management in industrialized countries, but given the relatively low concentration of heavy industries producing

¹ Mr. René Castro Salazar, Minister of Natural Resources, Mining and Energy, November 28, 1994

significant air pollution in Costa Rica, it would only have limited application in this country. Solid waste, however, could effectively be handled in an area-wide fashion, through the use of waste permits and waste exchange schemes.

The ESID team considered four options for regional environmental quality management: green businesses, joint treatment, discharge charges and tradable permits, and waste exchange.

Discharge charges and tradable permits

In Costa Rica the largest number of environmental protection measures come into the category of regulations. An alternative to the strictly regulatory approach of setting discharge conditions or emission standards, is to levy discharge or emission "charges", which are calculated so as to achieve an environmental quality objective at the minimum cost to the region. Industries may opt to either pay greater charges or invest in clean technologies or waste treatment to reduce these payments.

It is also possible for anyone to buy additional discharge "rights" from the issuing authority and resell them to other industries. The charges levied may be used for the construction of municipal waste management plants, which jointly treat municipal waste and the residual industrial waste, or for the development of funds to support waste minimization and resource efficiency schemes.

Theoretically, regional water quality management provides the possibility of reducing pollution at a minimum cost for the entire region. Furthermore, in order to achieve a water quality objective, an industrial plant may choose waste minimization and an efficient use of resources and materials in order to reduce treatment costs and discharge charges at the treatment plant's outflow.

However, the calculation of discharge charges requires a great deal of information of the receiving body of water (including existing water quality, water extraction and water uses), and the characteristics of discharges themselves. Therefore, such regional schemes would only be practical for well studied catchments with a significant concentration of industries like, for example, the Tárcoles river catchment.

In addition to baseline and discharge information an important amount of water quality modeling and economic calculations are necessary. The calculation of discharge charges, for instance, may require integer optimization programming and dilution and stabilization modeling in order to test if the charge levels achieve in fact the water quality standards required for the current and potential uses of water.

The savings made at regional level might not offset the time and effort involved in the investigation for setting up discharge charges and tradable permit schemes. For these reasons the ESID team considers that these schemes would only be applicable in the long term.

Joint treatment

The term joint treatment commonly refers to waste water, although it can also be applied for solid waste. When it is feasible to conduct waste water produced in a region to a single treatment site, wastes may be treated jointly, thus reducing the cost of treatment by taking

advantages of economies of scale. This approach also reduces the requirements of personnel as it facilitates operation and maintenance, which is centered in a larger facility rather than scattered in a number of smaller plants throughout an area.

In this case it is important that the facility operator sets up strict conditions to receive discharges into the system in order to avoid pipe clogging, reduction on treatability due to toxic wastes or overloading. Unsuitable discharges may be pre-treated prior to admittance into the joint treatment facility.

According to the law, municipalities should also be expected to treat their waste water, which is produced by housing, commerce and, indeed, industry in their jurisdiction. In this context, industries are responsible for their discharges into the sewer system and should therefore be liable to manage their waste themselves and/or pay for the treatment services provided by the municipality.

In Costa Rica a number of joint waste water treatment schemes have been introduced, particularly in industrial corridors and free zones. In the case of free zones, some offer simply municipal sewer system connections, others include "common sewage treatment" as one of their complementary services.

Waste exchange

Waste exchanges are mechanisms whereby the waste of one industrial activity might prove to be a valuable input into another industrial process. Exchanges work when:

- information about waste availability is publicized;
- lower quality demands for some materials exist (i.e., a waste is substitutable for virgin materials); and
- there is trust among parties about the content of the waste (i.e., it is of the composition claimed by the original generator, does not contain any unidentified contaminants or hazardous materials).

Rather than relying on waste exchanges, it is more efficient overall to make in-plant reductions of waste generation whenever possible. However, the technology and/or energy demands to achieve that may be too great or it might truly be more efficient to use the waste/residual products in less demanding applications. For example, chicken processing operations generate waste feathers and miscellaneous chicken parts as unavoidable byproducts. Since they are inedible to humans, they are collected and added to chicken feed.

Such exchanges are on-going in Costa Rica to some degree: there are waste exchanges organized by the University of Heredia and by the Chamber of Industries (the latter being for stable wastes only). Yet, the potential to be significantly expanded exists if: recovery of by-products can be enhanced and supply/demand for waste exchanging can be better coordinated; many exchanges evolved somewhat by chance. As observed during the visits to food processing facilities and assumed to be an issue at other industrial enterprises, a first effort must be to capture valuable wastes in a usable form. This may involve separating materials from waste waters and from each other to make them easier to handle

and reuse. Then, parties willing to reuse the wastes must be identified (see Attachment XII).

Despite the advantages to the environment resulting from waste exchanges, it is recommended that policy development emphasis be placed on prevention first and waste exchanges second because:

- waste exchanges are not comprehensive in that all wastes cannot be used by another enterprise;
- waste exchanges may continue to develop independently due to waste disposal and raw material acquisition pressures; and
- consulting services may also serve to identify additional or new exchange possibilities for wastes that are unmanageable through efficiency and prevention methods; waste exchanges would thus be a secondary effect of the policy promoted in Section 4.1.3.

3.2.2.5. Eco-friendly product certification (Eco-Labeling)

Product certifications of various types are used to help assure customers/consumers that certain characteristics or standards are satisfied by the product. Existing certifications include: flame retardancy of baby clothing, salt content of foods to protect those with heart disease, and power ratings for electrical equipment to protect against shock and fire. Many certifications rate the performance of the product in use. This is a significant difference from eco-labeling which might rate the product in use as well (such as for paints and their volatile chlorinated compound or mercury emissions) but which can range from ratings of environmental compatibility of the manufacturing process to whether environmentally sound options for product disposal exist.

The criteria against which to measure product eco-friendliness are varied and multidisciplinary and thus more complex to measure than flammability, food composition, and wattage. Hence, eco-friendly product determination should be conducted as a rigorous professional activity. For example, with any given product line, one production facility may have an excellent employee safety record and another may produce a product that can be returned to the manufacturer for 80 percent recycling. How do these two facilities compare on a sustainability index? Apparently, different levels and types of certification might be necessary. The complexity of comparing the relative environmental merits of different products --throughout their life cycles-- suggests that this is an effort that will not be mastered in the near term. It is subject to much debate about how much is enough, which factors are important, and how do they compare. Much information must be accessed to make determinations about product eco-friendliness. Eco-friendly labeling is open to abuse if not closely monitored and if testing and verification procedures are not well established. Consumer education is critical to achieving the desired results, that is support of true SID (i.e., consumer willingness to purchase potentially more costly but more eco-friendly products and ability to select "green" products). Administration of such a program is an enormous, expensive task.

This policy is not recommended for government implementation. It is anticipated, however, that various trade, research, and other organizations may develop certification programs which will address this issue in the near term. Their criteria for certification may

be designed around the particular interests of the individual certifiers. In the meantime, manufacturers may choose to add SID statements to the labels on their products. Eventually, standards should be established to protect consumers against basing purchasing decisions on spurious claims made by manufacturers.

3.2.2.6. Recognition of outstanding SID achievements

Awards (and other forms of recognition) for environmentally sustainable practices by industrial enterprises primarily serve to raise awareness of SID. Other industries can learn from the examples set by award recipients, if the information about the recipients is adequately distributed and/or made available. Positive public relations can result from such recognition, which is an added bonus and even encouragement to industries behaving in an environmentally sound manner. The public is also educated about the implications of its purchases; this is particularly important when a product with a more sustainable life-cycle must compete with less expensive products. The use of purchasing power must change as much as does the use of resources within production facilities. This concept of informed consumerism is closely tied to that of "Eco-Friendly Product Certifications".

Possible recipients of awards and other recognitions may be identified through:

- self-nomination (e.g., voluntary submission of case studies);
- nomination by qualified groups or individuals;
- committees of peers;
- submissions (by enterprises or individual employees) of special forms/applications that provide relevant information;
- etc.

To select those that are worthy recipients requires a knowledgeable evaluation team, time to investigate claims, and trust in the claims made (to minimize time and expenses invested in claim verification). In short, a significant effort must be expended to organize and evaluate a program of this kind. Such programs can draw much criticism for their selections of recipients of recognition. However, they often do a great deal to encourage communication among the public, government, and industry. Business/commercial enterprises are typically motivated to receive positive publicity, especially those whom have heretofore had trouble with public perceptions of their environmental behavior.

This policy option is not recommended for pursuit at this time because its function is already being served by a number of programs:

The Chamber of Industries presents yearly awards to industrial enterprises having demonstrated proactive environmental protection.

Each year, the University of Costa Rica's Industrial Engineering Department sponsors a week-long event on the "Quality of Life". During this event, environmental awards are presented to selected industrial enterprises.

In 1995, these two organizations plan to combine their efforts for recognizing environmental achievements of industry. This has several advantages, including that:

- the possible perception that the trade organization's promotion of member firms is self-serving can be offset by a university's participation; and
- sponsorship by a university may allow students to evaluate industry claims, thereby serving an educational function as well.

Furthermore, enterprise-level recognition of employee contributions to in-plant SID might be promoted in connection with Voluntary Codes of Conduct (see Section 4.1.4).

3.2.2.7. Creation of clean technology enterprises

Clean technology enterprises may be characterized as enterprises which:

- employ more efficient production processes, thereby generating less waste and/or less toxic/hazardous wastes;
- serve to recover value from the wastes of other enterprises; or
- provide the equipment, materials, and/or services that enable other enterprises to produce products more cleanly and sustainably (e.g., manufacturers of heat exchangers for waste heat recovery).

Support for such enterprises may include:

- special funds for development (see Section 4.1.5, policy for soft credit and subsidies for clean and/or more efficient technology initiatives in industry);
- preferential treatment in siting, permitting, etc.; and
- required use of services or equipment offered by such enterprises (e.g., government agencies' purchasing power may be used to financially assist clean technology enterprises).

Because inefficient use of resources and pollution emissions are becoming too expensive for industrial enterprises to continue, it is believed that with the proper support system of information dissemination and education (through consultants, universities, trade associations, etc.), enterprises will move towards cleaner technologies as a way to improve their competitiveness. Rather than pursue this policy independently, it is seen as a logical outgrowth of other policies proposed (see Section 4.1.3 in particular).

Furthermore, before clean technology enterprises can be created and supported, there is a need to know which clean technologies are appropriate to meet Costa Rica's SID goals. For example, a technology may be clean unto itself (e.g., it has no gaseous, liquid, or solid wastes emissions) and yet it is unsustainable because it:

- relies on resources not available in Costa Rica;
- is not competitive in domestic or foreign green markets; or
- does not satisfy critical quality of life requirements for Costa Ricans.

Additional direction is needed from the government to define country-wide sustainability objectives and constraints. Consider the case of a printing operation that wants to convert to non-toxic inks and waste ink recycling. Although cleaner than other methods for producing printed matter, the government's evaluation of sustainable information

dissemination systems may reveal that the use of electronic media is preferable to the use of forest products (i.e., paper) in Costa Rica.

The policy for consulting services sector strengthening is also seen as a precursor to this policy option. The consulting sector will contribute to the development of clean technology establishments by gathering information about industry's needs for recycling services, resource use efficiency equipment, etc., and then trying to satisfy those needs.

Lastly, there has been at least one course offered for environmentally friendly entrepreneurship development; it took place in late September of 1994 and was organized by the Environmental Enterprises Assistance Fund and EARTH (the School for Agriculture in Humid, Tropical Regions).

3.2.2.8. Compliance with standards in the country of origin

This policy consists in requiring all multinational firms, which intend to set up business in Costa Rica, to comply with the environmental standards and regulations in their country of origin, if they are more stringent than those in Costa Rica. This requirement is particularly relevant at present due to the attractive incentives offered by the government for foreign industries in free-trade areas. Similarly, free-trade agreements with Mexico and other countries may encourage the installation of polluting plants in Costa Rica, unless such a policy is established and enforced.

3.2.3. Financial and economic policies

3.2.3.1. Soft credits and subsidies for the application of cleaner and/or more efficient technologies in industry

The application of clean and efficient technologies in industry is increasingly perceived as a joint responsibility of industry, the government, the academic sector and the community. In Costa Rica, this has not yet been translated into concrete actions in the area of financing of environmentally sound modernization initiatives in industry, except for a private fund called "*Environmental Enterprises Assistance Fund*" which invests in private environmentally friendly projects in fields such as renewable energy sources and recycling.

Given the fact that financing is often cited as a major barrier on the way to sustainability in industry, it is proposed to design financing mechanisms which cater to the needs of private sector entities planning to create a business around clean products or services, or industries investing in clean or efficient production processes. In designing such mechanisms, the following factors may have to be taken into account:

- A difference should be made between pre-commercial projects (which will not be profitable as such) and commercial projects. In accordance with conditions in some of the more industrially advanced countries of Latin America such as Chile, a system of subsidies may be set up for the pre-commercial projects and soft credits for the commercial ones.
- Financing conditions may be more favorable for process changes and efficiency improvements than for end-of-pipe solutions.
- Industries based on the use of clean technologies, as well as some of the industries which introduce clean technologies in order to operate more sustainably, do not

usually have the collateral to back up a conventional loan application. Serious consideration will therefore have to be given to the introduction of technological guarantees as collateral.

- In view of the fact that clean technologies are often applied in technology based enterprises with relatively weak administrative capabilities, it is recommended to award an integrated package of financial and administrative support.
- The emerging field of environmentally sound products and services is expected to give rise to the kind of high-tech high-yield business opportunities which may appropriately be financed through mechanisms such as Venture Capital. There are growing indications that Costa Rican financing institutions as well as the donor community are getting ready for such riskier ways of financing, and it is expected that the prospect of being able to invest in environmentally sound projects will carry their efforts a step further.

3.2.3.2. Resource pricing adjustments

In Costa Rica, water consumption is priced on the basis of a unit rate for consumption and a significantly lower unit rate for discharge. In the process, it is assumed that the consumption volume equals the discharge volume. Waste water discharges are not measured. Clearly, this system provides no incentive to reduce the use of water.

On the other hand, energy pricing per unit decreases in a discontinuous manner as the consumption increases, and industries with a high consumption have to pay less per unit of consumption. As a result of this, strangely enough it is cheaper to use 24,000 kWh than 19,900 kWh² (see Figure 2), or, for smaller industries, it is cheaper to consume 5,000 kWh than 2,900 kWh. For a house with a high demand for energy (of over 2,900 kWh), it would be cheaper to qualify as an industry. A kWh used during peak hours (such as at noon or 6 p.m.) is priced at the same rate as a kWh consumed at 3 a.m.. Energy tariffs do not promote peak shearing, in order to avoid the use of diesel generator plants during peak hours, which are relatively expensive and generate air pollution.

Industries should be aware of the advantages of saving energy and water, not only for the environment but as a means to achieve financial savings. If an industry can save money by consuming more energy (as mentioned above), it will clearly not consider saving energy. Therefore, adjusting fees according to the amount consumed - the more you use the more you pay per unit - would create more concern on the part of managers to save on energy and water use.

However, adjusting resource prices requires a complex social, economical and ecological study to define a model of fees that would encourage industries to promote the conservation of resources to their employees and would be equitable among all sectors. Setting prices to reflect the full cost of these resources can do much to promote cleaner production. Ideally, though perhaps not feasible in the short term for Costa Rica, resource prices should reflect not only direct costs but also the costs of environmental impact.

² Rates are based on monthly usage.

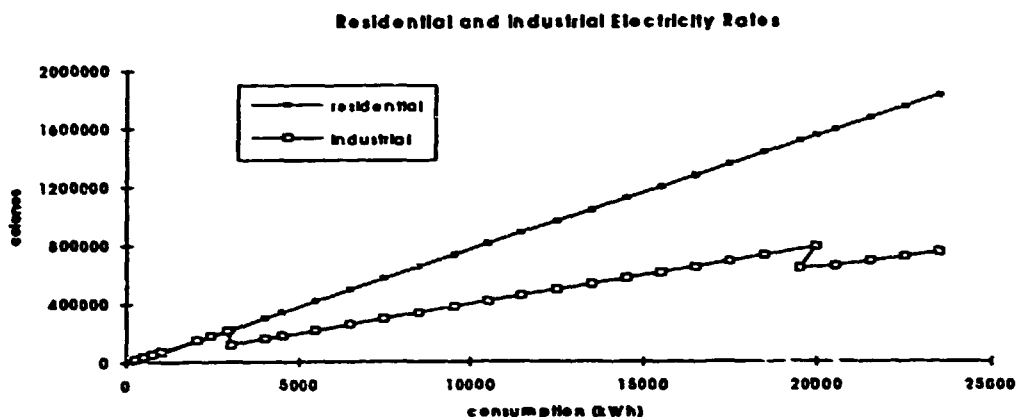


Figure 2. Residential and industrial electricity rates in Costa Rica, November 1994.
1 US \$ = ₡ 164.

At the present time, MIRENEM, the National Electricity Service (SNE), the Department of Energy Conservation at CNFyL and some external consultants are reviewing the energy pricing structure to develop a new one that would promote energy conservation. This project is part of the implementation of the above mentioned Law for the Rational Use of Energy.

A strong resistance to adjusting fees has to be expected among different Chambers of Industries, as:

"Principles of sound environmental [...] policies often mean the withdrawal of entrenched 'rights' -to pollute or to use resources- that tend to benefit the wealthy and influential, often at the expenses of the poor."³

Implementing such fees should be done after, or at least simultaneously with, an awareness building program on the reduction of water and energy use in the industrial and commercial sectors. A practical example of such a program is the nozzle program, as described in Attachment XI.

3.2.3.3. Import tariffs on the basis of sustainability criteria

Perhaps the most relevant example of a system of import tariffs on the basis of sustainability criteria is the newly introduced *Regulation for the Rational Use of Energy*⁴ in Costa Rica. The objective of this regulation is to protect the environment through the promotion of a rational use of energy. The system establishes additional import tariffs of up to 30% on the CIF value of household goods such as electric appliances and cars with

³ Source: The World Bank, *World Development Report 1992: Development and Environment* (New York, Oxford University Press, 1992)

⁴ Asamblea Legislativa de la República de Costa Rica - Regulación del Uso Racional de la Energía, Expediente No. 11.439, Decreto Legislativo No. 7447.

a less than satisfactory energy efficiency. Initially, the regulation will be implemented on the basis of a declaration of the importing agency on the energy efficiency of the imported goods, while a data base is being set up on benchmark energy efficiencies of the main energy consuming import articles.

In the framework of a comprehensive policy directed towards the promotion of Sustainable Industrial Development, the above described regulation may be amplified to include a wider range of sustainability criteria for industrial machinery. However desirable such arrangement may be, a practical problem will be to design a fair and widely accepted system of sustainability criteria (which would include, besides energy efficiency parameters, materials use and pollution criteria, among many others). Such multi dimensional sustainability system will give rise to arbitrary comparisons between options of machinery with entirely different kinds of environmental impacts. Although this situation may not differ substantially from the comparisons made in Environmental Impact Assessment studies, it is not considered practical at this point for industrial machinery. Rather, it is recommended to gradually widen the scope of the existing *Regulation for the Rational Use of Energy* to include industrial machinery, and evaluate the effectiveness of this regulation once the data base of benchmark equipment efficiencies has been established.

3.2.3.4. Tax incentives for pollution prevention and control

There are various options for tax incentives. For instance, industries introducing clean and/or more efficient technologies or treatment facilities would be able to deduct the value of the equipment acquired from their taxable profits. The acquisition of equipment for pollution prevention and control may be exempt from taxes or, in case such equipment is imported, no import taxes would be levied.

During the diagnosis of the food processing industries it was detected that tax incentives on clean and more efficient technologies will receive a warm welcome among the industrialists. It is considered highly probable that some sort of tax incentive scheme will be implemented in Costa Rica in the not too distant future.

3.2.3.5. Bans and penalties

There are four key steps to the use of bans and penalties:

1. selecting what is to be banned or otherwise strictly controlled - e.g., seasonal ban, partial ban/restricted use, etc.;
2. setting penalty levels;
3. detecting violations; and
4. enforcing penalty compliance.

The selection of chemical uses, processes, disposal and other operational practices can be complex; however, there are many existing examples of bans endorsed by other governments and/or international agencies. Thus, bans may be borrowed if deemed

appropriate to Costa Rican conditions.⁵ International bans that have bearing on Costa Rican product competitiveness in foreign markets might be adhered to, if only on an informal basis (e.g., ozone depleting substance labeling).

Setting penalty levels for the violation of bans is controversial. The less severe the penalties, the easier it would be to have them approved. However, their effectiveness declines with declining cost. Also, there is conflict between interests of employment (i.e., the financial stability of enterprises) and having penalties be strong deterrents.

Detection of violations would be difficult under existing circumstances of minimal inspection staff for relevant government authorities as well as limited laboratory testing capability on the part of the government. Enforcement will be compromised by the lack of detection ability. Unenforced bans may be worse than no ban. This policy is not recommended for further development at this time.

4. POLICY RECOMMENDATIONS

4.1. Proposed Sustainable Industrial Development policies

In the following section, only those policies presented in Section 3.1. that are considered most urgent and viable are elaborated upon.

4.1.1. Strengthening the Ministry of Public Health

1. Introduction

The Ministry of Public Health (MINSAL) has the prime responsibility for enforcing environmental legislation in Costa Rica. The Ministry's enforcement action in this field is undertaken by its Division of Environmental Sanitation (DSA), which provides the environmental criteria for issuing and renewing MINSAL's Sanitary Permits.

Sanitary Permits are required by the General Law of Health (Articles 291 and 298) for the operation of any industrial facility, and must be renewed every year prior compliance of a number of requirements in relation to pollution control. According to MIRENEM's Law for the Conservation of Wildlife (Article 132), all releases of waste water to natural streams, lakes, etc., are forbidden. Industries must have waste water treatment to avoid pollution that may destroy wildlife. They are required to comply with this condition by December 1994, which is the end of a two-year grace period granted by the law. Pollution control requirements are also explicit in the General Law of Health, and expanded to pollution sources of air and soil (Articles 300 and 301).

MINSAL is in charge of enforcing the General Law of Health in terms of pollution control and certifying that the design of waste water treatment plants fulfills the requirement of the Law for the Conservation of Wildlife.

⁵ For example, the evidence of severe human and environmental health degradation caused by the use of DDT has caused it to be banned in the US and elsewhere. However, if this ban or another were to be considered for application in Costa Rica, then the experience of the ban's implementation in its country of origin should be studied carefully beforehand.

Although Sanitary Permits are the most effective means available to Government authorities for pollution control in industry, the DSA has limited capabilities to supervise that the legal requirements are met. The DSA's responsibility to approve the design of treatment facilities produces an additional burden to the Ministry's scarce resources.

The SID team recommends that MINSAL focuses on ensuring that the environmental quality criteria are met, leaving the responsibility for the design of treatment systems and other options to industry itself. It is strongly believed that MINSAL, as well as other authorities in charge of enforcing pollution control regulations, should be encouraged and supported to adopt a preventive approach, which seeks an efficient use of resources and minimization of waste.

2. General Objectives

There are two general objectives to be achieved through the proposed policy for MINSAL:

1. To strengthen the capabilities of the Division of Environmental Sanitation (DSA) to develop and enforce regulations and emission standards from a preventive point of view.
2. To convey the SID message with multimedia environmental quality enforcement.

To achieve the first objective, inter-institutional coordination and collaboration should be enhanced.

With respect to the second objective, it is critical that MINSAL's responsibilities for environmental protection be made more comprehensive through the adoption of a multimedia approach to regulations and their enforcement. The evaluation of industrial impacts on the environment in an integrated and complete manner lays the foundation upon which other policy objectives may be pursued. As an example, the development of an internal consultancy capacity for clean technology development will heavily depend on multimedia regulations.

3. Specific Objectives

1. To develop the capacity of DSA to gather, manage and utilize information and documentation on industrial processes, emission standards, discharges and emissions.
2. To help DSA to strengthen its capabilities and to enhance its status in MINSAL.
3. To develop regulations for the General Law of Health in order to emphasize a preventive and multi-media approach.
4. To review procedures for issuing and renewing the Sanitary Operation Permits, in order to encourage pollution prevention with a multi-media approach.
5. To develop emission standards in order to turn the emphasis of the current legislation from requiring waste treatment to encouraging waste minimization and resource efficiency.
6. To train MINSAL and MIRENEM staff, consultants and industrial entrepreneurs on pollution prevention with a multi-media approach.
7. To strengthen the capabilities of "official" laboratories to be able to respond to demands for certified laboratory reports and for certification of private laboratories.

4. Implementation Path

Policy Components

The policy for the institutional strengthening of MINSAL would consist of the following components.

1. Information

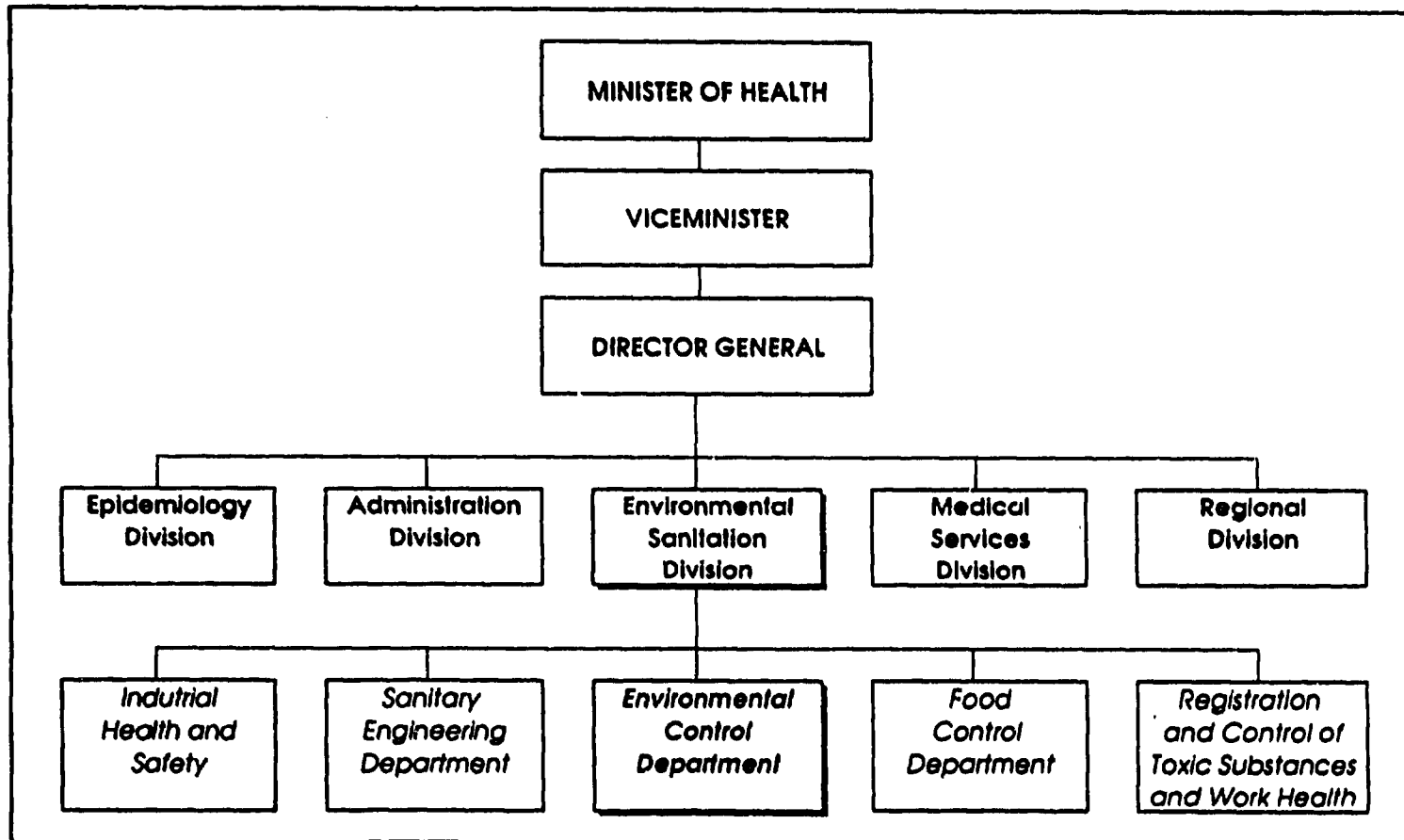
The types of information needed to support MINSAL's responsibilities for multimedia regulation, and protection of environmental quality to sustain human health, can be divided into two basic categories. The current status of information access is also noted below.

- *Information obtained from external sources (e.g., international information databases, literature, case studies, and conference proceedings).* It is not necessary to duplicate the development of such information. However, access to external information is important and, although being pursued by various aid agencies, warrants additional resources such as bilingual staff and computers for MINSAL. The DSA has a small number of formal (published books and periodicals) and informal (thesis, guidelines, internal reports) documents, both Costa-Rican and foreign. Scattered libraries and private collections have additional documentation but there is no systematic way, as yet, to find the documents available in each institution.
- *Data about industrial-environmental conditions specific to Costa Rica (i.e., internal information).* Some information of this type already exists or is underway:
 - Hazardous materials registry. Overseen by the Department for Registration and Control of Toxic Substances and Occupational Medicine.
 - SIMARDI (Information System for Waste Water and Industrial Waste). This computerized database was developed by the DSA in FOXBASE, with support from the Pan American Health Organization (PAHO), to manage information on industrial processes, emission standards, discharges and emissions. It is still in the try out stage with partial data. Some of the data is obtained from documents submitted by industry in connection with permit applications to DSA. Waste water discharge monitoring data, as collected by MINSAL inspectors, is entered into the computer for automated comparison to the discharge standards.
 - UNDP's initiative to establish a Sustainable Development information network in Costa Rica.
 - PAHO-sponsored sanitary survey. Developed, though not yet administered, to help classify industries and their range of activities, and to prioritize areas for further investigation. Resulting data of "yes/no" responses will be computerized for analysis.

2. Organization

At present, MINSAL is organized as shown in Figure 3. However, it is going through an important reorganization which intends to divide substantive responsibilities between two Directorate Generals, one of them dealing with issues related to medical and public health, and the other with environmental and occupational health as well as food.

Figure 3.
Organic Structure of the Ministry of Health (MINSAL)



The aim of this component is to upgrade the capabilities of the present Division of Environmental Sanitation (DSA) in order for it to become a Directorate General. Thus it will act as a second-tier institution, in charge of the coordination of all enforcement activities on pollution prevention and control through a multi-media approach.

3. Regulations

The role of environmental regulations is to modify industry's behavior in order to reduce its environmental impact. The two main effects of regulatory programs are the following:

- They establish standards for industry that specify the required pollution control activities or the permitted amount of pollutant discharges.
- They establish procedures in relation to permits for installation and operation.

This component would aim at clearly defining responsibilities and procedures for the enforcement of environmental laws. It focuses on reviewing the existing draft regulations for the General Law of Health (GLH), and on developing regulations for the Law for the Protection of Wildlife (LPWL), in order to enhance the multi media approach of the former and introduce an emphasis on prevention in the latter.

At the time of writing this report, MIRENEM and MINSAL had started the preparation of a set of regulations in order to integrate all procedural instruments for water pollution prevention and control, thereby regulating both GLH and LPWL for that specific medium. As the LPWL requires that industries install waste water treatment systems by December 8, 1994, these regulations would give non-complying industries the opportunity to submit an action plan committing them to gradually minimize or control their waste water discharge according to a specific timetable.

4. Procedures

At present, the DSA makes use of a number of procedures for issuing and renewing MINSAL's Operational Permits which emphasize compliance with single-medium (e.g., water) treatment efficiency standards defined by the Division. These procedures are compiled in the Division's internal guidelines, and involve the following actions:

- providing environmental criteria for issuing and renewing MINSAL's sanitary permits that specify the environmental requirements for each industrial plant or location;
- monitoring the compliance of industry with the permit requirements;
- enforcing permit conditions with informal, administrative, civil and/or criminal sanctions, as applicable.

It is proposed to review these procedures in order to introduce the option of pollution prevention through a multi-media approach.

5. Standards

Although MINSAL is involved in environmental issues both within and without industrial plants, this component focuses on standards for external pollution prevention and control. There are three ways to define environmental standards:

- ❑ *Technology based standards* require industry to reduce pollutant discharges based on the expected performance of the available technology, without considering the actual effects on the environment. This is the approach of the Law for the Protection of Wildlife pertaining to waste water discharges.
- ❑ *Ambient-based standards* require industry to reduce pollutant discharges to the extent necessary to achieve a defined ambient quality objective. This is the approach chosen by MINSAL and MIRENEM to develop standards for the existing environmental legislation.
- ❑ Between these two extremes are *benefit-based standards*, which require industry to reduce pollutant discharges only to the extent that there would be a reasonable balance between benefits and costs. This is the approach that the industrial sector would prefer.

This component aims at supporting MINSAL and MIRENEM's efforts in the development of single-medium ambient-based standards. However it would encourage monitoring and enforcement according to a multi-media approach. The proposed regulations would procure the enforcement of these standards through negotiated voluntary agreements.

6. Training

In order for MINSAL/DSA staff to respond appropriately to SID demands, including the new multimedia control and preventive responsibilities proposed therein, some training⁶ will be necessary to allow them to:

- ❑ be able to evaluate multimedia implications of industrial behavior (especially during facility inspections); and
- ❑ fairly compare pollution prevention techniques such as clean production, waste minimization, and resource efficiency, to more conventional treatment methods (particularly when reviewing permit applications).

Multimedia training will have to be coordinated with:

- ❑ the promotion of internal communication among MINSAL staff with expertise in various disciplines (e.g., air or water experts); and
- ❑ the addition of multidisciplinary talents to help integrate and facilitate coordination among MINSAL expertise.

It is not envisioned that MINSAL/DSA employees will have to become experts in clean production, but rather that they be familiar with relevant concepts and technologies because:

⁶ Prior to initiating training, a survey of staff will be necessary to determine: how many need be involved in training; what are existing skills and responsibilities; what will be the schedule for training; which MINSAL staff can conduct part of the training; what training must be sought from outside MINSAL (e.g., other Costa Rican Ministries, national universities, domestic and international consultants); etc.

- the main purpose of prevention training is to enable MINSAL/DSA personnel to balance the effectiveness of sustainable industrial practices against conventional treatment technologies;
- techniques and technologies for clean production are ever changing, and, if only for time constraints, it is considered difficult for MINSAL employees to keep fully abreast of all such technologies; and
- industry is expected to seek the services of specially trained consultants for SID analysis, design, and implementation.

In order for MINSAL/DSA inspectors to better understand and evaluate industrial operations, several types of training are useful:

- what are basic industrial process principles;
- how to design and plan appropriate monitoring programs; and
- how to perform multimedia inspections.

Inspector's SID awareness may be enriched through:

- apprenticeship to experienced (perhaps international) industrial inspectors and auditors;
- numerous existing documents of industrial facility and new technology case studies (available through UNIDO, UNEP, Canadian Office of Waste Management, United States Environmental Protection Agency, and others).

For permit reviewers' general advancement and to develop their ability for continuous evaluation of emerging technologies, it is suggested that MINSAL/DSA employees first receive training on how to perform materials balance calculations. Subsequently, they need access to technical information about:

- non-hazardous, non-toxic materials substitution for hazardous chemicals;
- alternative procedures for basic facility operations (e.g., for cleaning: dry wipe, ultrasonic, bacterial; for cooling systems: closed loop with heat recovery; for rinsing: static rinses, counter current, cascade); and
- performance of different types of recovery/reconditioning equipment (e.g., when and where can ion exchange units be used to remove waste materials from waters, to recondition the waters for recirculation and to recover water materials for reuse).

Sources of the technical information identified above include:

- literature from vendors of recovery/recycling systems and services;
- university seminars (activity in clean technology studies is increasing, as demonstrated by the waste exchange and other on-going efforts at the University of Heredia);
- conferences; and
- Clean technology information centers.

7. Monitoring and analytical laboratory capabilities

In order to ensure compliance with forthcoming emissions standards, monitoring of industrial sources will be necessary. Monitoring may be initiated and overseen by MINSAL, by the individual industrial enterprises, or by third parties (e.g., universities, consultants, citizens' groups, government contractors). In all cases, laboratory capacity does not appear to be sufficient for the substantial increase of monitoring activities which is to be expected in Costa Rica. Therefore, possible means of enabling MINSAL to carry out its environmental quality enforcement responsibilities through the analysis of industrial emissions would include:

□ *Expansion of MINSAL's Internal Analytical Laboratory Capabilities*

At present, the laboratory used by MINSAL is called INCIENSA. This independent lab is attached to MINSAL and may be officially taken over by the Ministry in the future. INCIENSA focuses on food safety analyses, although it also has limited waste water analysis capabilities and might be expanded into broader industrial monitoring activities. Three internal laboratories specialize in chemistry, microbiology, and medicines (with some analytical capacity for toxics). University laboratories have been used to some degree in the past. MINSAL, with the assistance of the Pan American Health Organization (PAHO), is considering significant expansion and strengthening of its surveillance capabilities with a system which will include the following types of laboratories:

- bacteria;
- physical and chemical properties;
- heavy metals, pesticides, and hazardous materials; and
- certification and quality control (see Figure 4 and below).

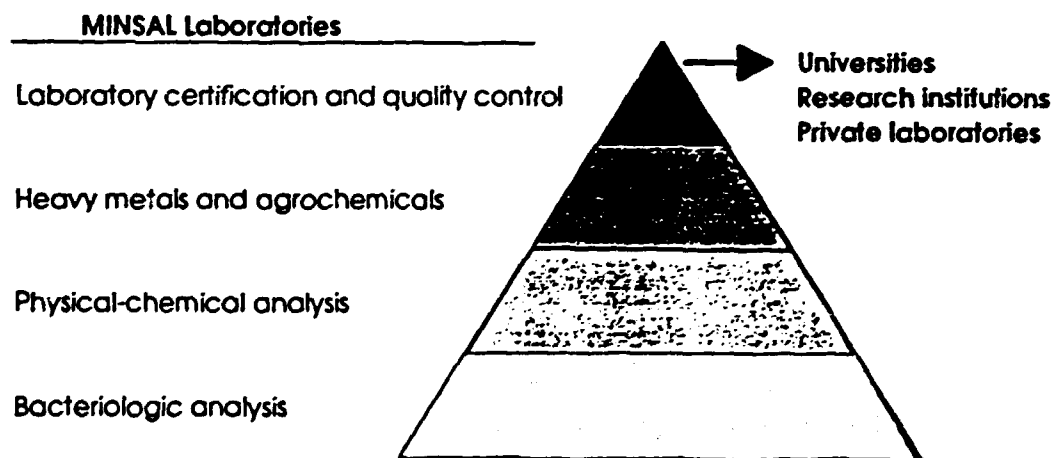


Figure 4. *Hierarchy of Environmental Laboratories in Costa Rica.*

MINSAL authorities perceive the acquisition of equipment as the primary obstacle to the creation of expanded surveillance laboratories.

Improve Field Analytical Capabilities

Improvement of field analytical capabilities is another important upgrade to MINSAL's surveillance system. Alternatives to MINSAL's field testing are not readily available plus it would be more efficient if MINSAL inspectors were able to conduct field testing themselves rather than involving additional people. This again requires equipment and training.

Certification and Quality Control

One of MINSAL's laboratories should be in charge of the certification of other laboratories (e.g., for AyA, universities, private enterprises). The certification process would help to ensure reliable performance of high quality analyses.

Options that may be employed in the near term, until MINSAL's laboratories are fully developed, include:

Agreements with Universities

Certain universities in Costa Rica have advanced analytical capabilities as well as experience in evaluating industrial emissions and environmental quality parameters. Their existing laboratory infrastructure diminishes the immediate need for new investments in facilities, equipment, supplies, and staff. Laboratory students could gain valuable practical experience. However, it must be noted that only advanced students with proven laboratory skills should be permitted to conduct analyses for MINSAL. It is further envisaged that universities would have only a minor role in industrial emissions testing beyond the short term. Universities' contributions to SID are better made in pure research and development rather than monitoring.

Contract with Private Laboratories

There are at least four private analytical laboratories in Costa Rica at the present time. They perform emissions analyses for industries preparing permit applications or fulfilling MINSAL monitoring requirements⁷. Like INCIENSA, they may be used to supplement MINSAL's internal laboratory capabilities. Experience gained serving MINSAL's needs would strengthen private laboratories for future service to industries. (For instance, in Attachment XI, a proposal is made in which laboratory services would be expanded into process water and upstream waste water quality analyses, rather than only final discharge quality.)

Time frame

As discussed earlier in this section, the strengthening of MINSAL, particularly as regards its functioning as a multimedia regulatory and enforcement agency, is a critical catalyst

⁷ Industry must have its waste waters analyzed every three months, either by the enterprise's own laboratory or by a private laboratory. Once a year the analyses must be performed by the national laboratory. MINSAL has the power to make surprise visits and collect samples for analysis at any time.

to other policies and actions for SID in Costa Rica. Thus, most of the objectives presented above require immediate and near term implementation.

To lay the foundation for MINSAL's proposed new functions, the reorganization of MINSAL to enhance the DSA and promote multimedia coverage is considered urgent. Once an appropriate organizational structure is defined, MINSAL may proceed to revise regulations, standards, and procedures thereof. Training will be required in the short term to enable staff to interact effectively with the consultants initially providing guidance to these efforts. The trial information system, SIMARDI, needs to be enhanced in the short term so that its data might be used to prioritize and/or formulate policies to meet other short term objectives.

In the longer term, training will have to continue as a regular activity. Because laboratory capabilities require significant investments in equipment, their development will not be completed in the short term. Since certification and quality control activities depend on the presence of sophisticated, fully operational laboratories, these components will also await fruition until the medium term.

Organizations involved

Some of the organizations to be involved in MINSAL's strengthening already have an established working relationship with the Ministry. PAHO in particular has been doing a great deal to assist with internal information development efforts and laboratory capability planning. Since new directions in MINSAL's responsibilities are also being recommended, new alliances and forms of assistance will be necessary. Foreign enforcement agencies having multimedia authority experience, their inspectors, and/or the trainers of their staff and inspectors will be appropriate for training, under the agency's auspices, of MINSAL staff.

Resources required

Short term strengthening efforts will require significant external resources for their existing experience in the fields of: (i) information systems development; (ii) preventive and multimedia organizational structuring and training; and (iii) coordination of regulations, standards, and procedures. Over time, that experience and expertise is to be transferred to and nurtured within MINSAL's staff.

With the exception of laboratory enhancements, the capital costs for implementing this policy's components are relatively low. As discussed under "Viability" below, many countries are interested in the pursuit of policies such as the one proposed and it is therefore considered quite feasible that the resources required for the consulting and training services can be generated.

Expected results

Implementation of the policy components identified in this section are expected to result in:

- Better enforcement of environmental quality standards (through improved monitoring, analysis, inspection, data management, and standards definition).

- MINSAL's ability to assess the overall impact on the environment of industrial facilities, avoiding the shift of pollutants from one media to another.
- A clear definition for environmental behavior through which industrial enterprises can plan for SID in the short and longer terms.

Viability

Countries with more developed regulatory and enforcement systems, focused on individual media and end-of-pipe controls, are having to make significant efforts to redesign their systems in favor of multimedia and preventive approaches to protecting environmental quality. In view of this, it is not only viable but essential that Costa Rica takes advantage of the opportunity to strengthen its environmental protection system in a more sustainable way from the outset, before unsustainable habits are entrenched in the government and industrial sectors.

Many countries are interested in Costa Rica's commitment to sustainable development and would be willing to assist in the process of making sustainable development a reality in industry. Costa Rica's manageable size, state of development, democratic governance, and educated and skilled population make it an excellent candidate for exploration into SID.

STRENGTHENING OF MINSAL

COMPONENT	TIMING	INSTITUTION RESPONSIBLE	INTERNAL RESOURCES	EXTERNAL RESOURCES	EXTERNAL FUND SOURCES
1. INFORMATION - Develop SIMARDI - Document. Bank	Ongoing Short term	DSA, MICIT/ UCR/AyA	Staff, equipment, documentation	Consultancy, equipment, documentation	OPS/GTZ OPS/UNEP/UNIDO/GTZ
2. ORGANIZATION Enhancing DSA	Immediate	MINSAL/DSA	Staff	Consultancy	OPS/NL/IADB-CABEI
3. REGULATIONS - for GHL - for LCW	Short term	DSA/ MIRENEM	Staff	Consultancy	IADB-MIRENEM
4. PROCEDURES Sanitary Permits	Short term	MINSAL/DSA	Staff	Consultancy	IADB-MIRENEM
5. STANDARDS - discharges - emissions	Ongoing	DSA/ MIRENEM	Staff	Consultancy	IADB-MIRENEM
6. TRAINING - prevention - multimedia	Short term+ continuing	DSA, UNA, UCR, cons.	Staff	Consultancy, trainig visits	UNFP/UNIDO/NL/ EU/GB
7. LABORATORY CERTIFICATION - field testing - oficial labs	Midium term	DSA/ INCIENSA/ public labs	Staff, equipment, materials	Consultancy, equipment, materials	NL/SW/GB

4.1.2. Strengthening of the EIA commission

1. Introduction

In Costa Rica, the requirement for environmental impact studies is explicit in the EIA Regulations set up by MIRENEM's Decree No. 23790, signed 28 October 1994. EIA is mandatory for projects with potential negative effects on the environment of either moderate or significant intensity. Other projects may also require an EIA depending on a number of criteria stated in the decree, such as the sensitivity of the proposed project location.

The decree establishes the National Commission for Environmental Impact Assessments (CONEIA), which replaces a previous agency with a similar mandate created in 1992 by decree 21930 (superseded). The functions of CONEIA include: developing EIA guidelines, a number of which are already in place; defining whether an EIA study is required; analyzing, evaluating and approving the study, as appropriate; and monitoring the implementation of prevention or mitigation measures proposed in the study.

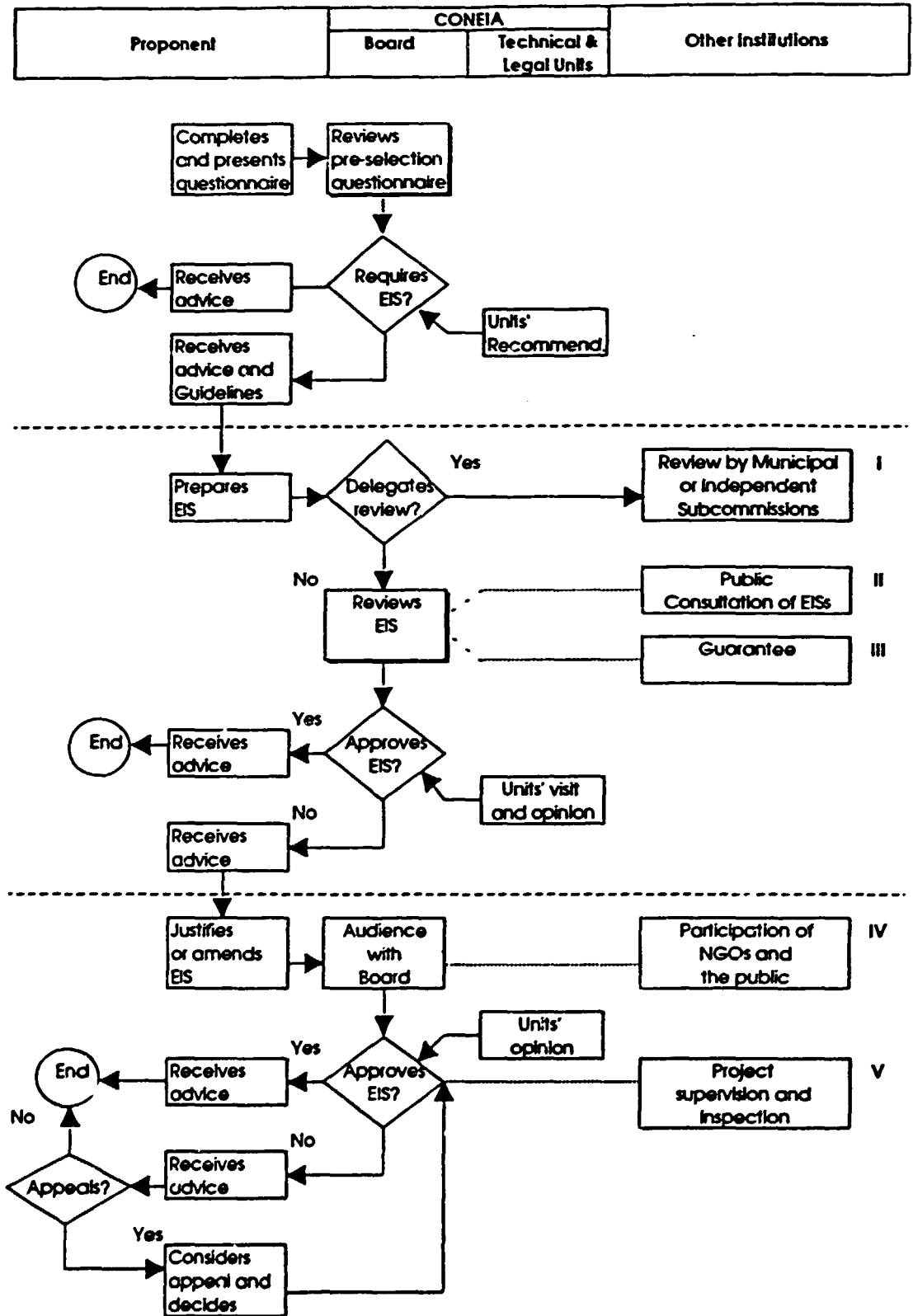
The regulations describe the EIA procedure as shown in Figure 5. It is divided in three parts as follows: project screening, by means of a pre-selection questionnaire; EIA review and approval; and improving an EIA statement and/or appealing against a negative decision. Supplementary procedures are marked with Roman digits I to V, comprising review by sub-commissions, public consultation and participation, setting up of guarantees and project supervision and inspection.

The requirement for EIA studies in Decree No. 23790 is defined in terms of type and size of project and the characteristics of the proposed project site. Developments requiring EIA are public or commercial infrastructure projects including mining, tourism, urban development, power generation and agriculture sectors. In some cases industrial projects will also be subject to an EIA procedure, either voluntarily or by specific requirement of CONEIA.

Given the wide range of its mandate, the Commission is likely to find difficulties dealing with the number and variety of developments that would be introduced into the EIA procedure, unless a clear mechanism for delegation to municipalities and sector institutions is devised. It is also important to develop the capabilities of local and sectoral institutions and of private consultants, to enable them to respond to the increasing demand for formulation and review of EIA studies. Another problem facing the Commission is that its jurisdiction goes as far as approving or rejecting the EIA study, but its decision may still be overruled by the municipality, even on environmental grounds, at the time of studying applications for installation permits.

The strengthening of CONEIA should focus on rationalizing the EIA procedure and clarifying the responsibilities of competent and permitting authorities, in order to avoid conflicts which may unduly delay viable projects. It should also include support in the preparation of the pre-selection questionnaire and guidelines for the preparation and review of the EIA reports. However, success in the application of an EIA procedure does not only depend on the corresponding authorities; the capacity of consultancy companies in the preparation of EIAs should also be strengthened.

Figure 5. Environmental Impact Assessment Procedure as per Decree 23790



MIRENEM and CONEIA are aware of the need to strengthen the Commission's capacity for reviewing the studies and for ensuring that environmental considerations are introduced into the conditions for the municipalities to issue licenses and permits. To achieve this, a thorough review of the current procedure and, possibly, a widening the Commission's authority on EIA, are in order.

2. General objective

To strengthen the capabilities of CONEIA to develop and enforce effective regulations, procedures and guidelines for the preparation, submission and review of environmental impact studies (EIS), and ensure that the prevention and mitigation measures identified in the EISs are indeed implemented.

3. Specific objectives

- To develop an information system to enable CONEIA to monitor compliance with the requirements of the EIA regulations.
- To strengthen the capacity of CONEIA's board and the technical and legal units, and to support the development of EIA capacity in municipalities and sector institutions.
- To review the EIA regulations in order to emphasise coordination between the competent and the licencing authorities.
- To develop procedures for inter-institutional coordination, public participation, application of guarantees, EIS review, supervision and inspection.
- To develop guidelines for the preparation of EISs and the pre-selection questionnaire.
- To train CONEIA staff, government agencies, project proponents and consultants in environmental impact assesement.
- To introduce risk assessment as one of the components of a full EIA of industrial projects.

4. Implementation Path

Policy Components

The policy for the strengthening of CONEIA has the following components:

1. Information

It is recommended to develop a computerized system to gather and process information regarding projects subject to the EIA procedure, in order to facilitate CONEIA's supervision and inspection activities. This information system could either be independent or become a component of existing systems, such as SIMARDI which is run by MINSAL. The development of the information system would involve the following activities:

- identification of information needs;
- definition of the data base application and computer equipment required, considering compatibility with other systems already in place;

- acquisition of hardware and software as required;
- design and development of a new information system or expansion of an existing one;
- systematic information gathering and processing.

2. Organisation

It is suggested to strengthen CONEIA's organization, with an emphasis on the board and the technical and legal units, in order to enable them to undertake (or delegate) their responsibilities under the current regulations.

This component will involve two main activities:

- Identification of the needs for human, financial and material resources within CONEIA and other institutions, as well as consultants involved in the EIA procedure by delegation.
- Definition of the type of support required to fulfil the needs identified, such as additional staff, coordination mechanisms, procedures and guidelines, training, equipment, information and documentation, as described in this section.

3. Regulations

The aim of this component is to assist MIRENEM in reviewing EIA regulations (decree 23790) in order to clarify responsibilities and actions of the various stakeholders. In this context, the need is emphasized for a close coordination between CONEIA, acting as competent authority in EIA, and the municipalities which, as licencing authorities, make the final decision regarding an industrial development. An initial review was undertaken as a direct support from the SID team during their mission in Costa Rica.

4. Procedures

This component aims to clarify a number of issues in the general procedure as described in Decree 23790. These include the involvement of sub-commissions, and conflicts in the timing of various steps of the procedure. This component would also address the assessment of siting, technological and design options, rather than simply define ex-post mitigating measures.

In addition, there are a number of activities which are mentioned in the EIA Regulations (marked with Roman numerals in Figure 5) and require an in-depth description.

This component includes the development of the following procedures:

- I. Coordination with permitting authorities;**
- II. Consultation of EIA reports;**
- III. Setting up of guarantees;**
- IV. Participation of NGOs and the public; and**
- V. Supervision and inspection.**

5. Guidelines

There are a number of guidelines for EIS formulation in Costa Rica, such as those for mining and hydrocarbon exploitation, as well as tourism developments. However, they require an extensive description of baseline environmental conditions and emphasise mitigation and control measures. The prescriptive nature of existing guidelines tends to produce a rigid approach to EIS preparation.

This component aims at reviewing the existing guidelines and developing new ones which would address the need for efficiency and practicality. The contents of the new guidelines would be focused on the most important sectors of the economy, allowing for further subdivisions in the case of some large sectors, such as industry.

General guidelines, applicable to any kind and size of project may contain the following sections:

- legal and institutional framework for EIA;
- the EIA procedure;
- scoping the EIS; and
- contents of an EIA.

Generic -- or sectoral -- guidelines will include a list of typical environmental and social implications of sectoral projects and some preventive and mitigation options associated with each impact. This approach would give the proponent an opportunity to determine the scope of the EIA study and the methodologies and techniques available, emphasising the assessment of siting and technological options of the project. The proponent would be encouraged to contact both competent and licensing authorities in order to focus the EIS as required, thereby avoiding unnecessary delays and costs.

This component also includes support for the preparation of the pre-selection questionnaire, in order to facilitate definition of whether an EIS is required and how ample and thorough it should be.

6. Training

This subject of training has a direct relationship with the strengthening of CONEIA. It will include the definition of human resources requirements to respond fully to the EIA regulations.

The aim is to enhance skills and knowledge for the following activities:

- development of procedures;
- preparation of questionnaires and guidelines;
- screening projects for the EIA procedure;
- reviewing EISs;
- undertaking project inspections.

As a result of this analysis, the training needs would be assessed. Finally, a complete training program would be prepared, including a number of options such as the following:

- short courses;
- training visits abroad;
- on-the-job training in Costa Rica;
- seminars for decision makers.

Courses would be targeted to mixed audiences with participation from government agencies, private enterprises, higher education and research institutions, municipalities, NGOs and consultants.

7. Risk assessment

An event of risk, such as explosions, spills and leaks of hazardous materials, could produce much greater environmental damage than the routine operation of an industrial plant. This component seeks to define a procedure for identifying the potential risks and preventing their causes as part of a full EIA as required in the EIA regulations. It could also include the preparation and delivery of workshops on risk assessment using the World Bank methodology.

Timeframe

The most urgent action regarding strengthening CONEIA is the review of the EIA Regulations, which were published in the official Gazette on 1 December 1994. Most of the other components can be undertaken in the short term (within the coming three to six months). Training would require continuous refreshing exercises in addition to short term action. The introduction of risk assessment into the EIA procedure would have to take longer to implement as there is no provision for it in the EIA regulations. It is envisaged that the development of the latter component would not take place before 1996.

Organizations involved

The organizations involved in this component are the following: MIRENEM, particularly for the review of Decree 23790; CONEIA (which was officially established upon the publication of the EIA Regulations), acting as competent authority; INVU for land-use planning and MIDEPLAN for planning and budgeting public developments; municipalities, acting as licencing authorities; universities and private consultants.

Resources required

Institutional strengthening projects such as the one at hand would require a strong participation from staff of competent and licencing authorities, on top of external support, primarily from national and international consultants. The bulk of the financial resources would be spent on salaries to consultants and on airfares and per-diems. Training would need additional financial resources for the preparation and production of training materials, equipment and the venue. Additionally, the development or extension of an EIA information system would require computer equipment and software.

Financing for the Information System may come from the same source as SIMARDI, namely PAHO, with a supplement from a bilateral organization such as the cooperation institutions of Canada, the Netherlands, Sweden or Great Britain. The development of procedures, guidelines and training can be lumped in a single package under the auspices of a bilateral donor or international NGO. For instance, similar packages have been supported by the UK in Pernambuco, Brazil; in Monterrey, Mexico, by the European Union; and in Panama by the NGO World Conservation Union (IUCN). The World Bank has also provided funding in the past for the development of EIA institutions in Bolivia and Chile, but this source may not be available in the case of Costa Rica.

5. Expected results

The above components would aim at responding to the above-mentioned objectives as follows:

- A strong CONEIA, able to respond to the requirements of the EIA regulations.
- Clearer and more enforceable EIA regulations and procedures.
- User-friendly guidelines and a pre-selection questionnaire.
- A critical mass of trained and able CONEIA staff, and professionals to support and follow-up on CONEIA's action.
- A risk assessment component for every complete EIA of industrial projects.

6. Viability

Comparing the Costa Rican case with similar situations in other countries, the strengthening of CONEIA is highly viable at a comparatively low cost. However, a number of conditions apply, as follows:

- political decision of competent and licencing authorities to work together;
- external support to initiate institutional strengthening actions;
- financial resources not only for consultancy and training but also for hiring additional staff for CONEIA if and when needed;
- willingness of the proponent to finance various steps of the EIA procedure as stated in Decree 23790.

STRENGTHENING OF CONEIA

COMPONENT	TIMING	INSTITUTION RESPONSIBLE	INTERNAL RESOURCES	EXTERNAL RESOURCES	EXTERNAL FUND SOURCES
1. INFORMATION	Short term	MIRENEM/ MINSAL	Staff	Consultancy, equipment and software	Canada/NL/SW/GB
2. ORGANIZATION Enhancing CONEIA	Short term	MIRENEM/ CONEIA	Staff	Consultancy	Canada/NL/SW/GB
3. REGULATIONS Decree 23790	Immediate/ Urgent	MIRENEM	Staff	Consultancy	UNIDO/ESID
4. PROCEDURES - Coordination - Public consultation - EIS review - Project supervision	Short term	MIRENEM/ CONEIA	Staff	Consultancy	IUCN
5. GUIDELINES - pre-selection quest. - EIS guidelines	Short term	CONEIA	Staff	Consultancy	Canada/NL/SW/GB
6. TRAINING	Short term+ continuing	CONEIA, cons., municipalities	Staff	Consultancy, trainig visits	GB/ICI
7. RISK ASSESSMENT	Midium term	MIRENEM/ CONEIA	Staff	Consultancy	Canada/NL/SW/GB

4.1.3. Strengthening of consultancy capabilities

1. Introduction

It is envisaged that the demand for SID consultancy services will receive a significant boost by the suggested multimedia responsibilities for MINSAL (Section 4.1.1.) and by the new requirements of the recently formed CONEIA (Section 4.1.2.).

On the other hand, in order to create and broaden the supply side of the SID consultancy business, specific programs may be set up for the transfer and exchange of SID methodologies, originating either from public and/or private entities in foreign countries or from advanced local organizations. Additionally, existing local management consultancy firms may be made aware of the principles of SID, in order for them to incorporate these in their services.

MINSAL's multimedia requirements

With multimedia regulations existing from the outset of environmental impact mitigation or pollution control projects, the orientation of consulting services will be guided towards SID. Consultants designing waste water treatment or other end-of-pipe treatment systems will become aware of the constraints on the designs of those systems from the point of view of sustainability. They will be forced to consider the impacts of industrial processes on all media. The need to minimize waste generation will be obviated to consultants seeking to provide their clients with optimal solutions to pollution.

To further ensure creativity and responsiveness on the part of consultants to the new multimedia perspective of industrial emissions controls (or prevention), industrial managers will also need to be made aware of the implications of these new regulations upon their operations. They will need to know what questions to ask and what demands to make of consultants providing them with emissions control services. In this way, they will not be lead down a path of expensive control after control and consultants will need to focus their service efforts on improved process efficiency and on recovery and reuse of waste materials.

CONEIA's requirements

The preparation and submission of EIA studies, and the implementation of the environmental management strategy that results from them, are the responsibility of the project proponent. The proponent may be able to undertake the EIA study in-house but, more often, has to rely on an independent EIA team, which is usually a consultancy firm. One of the proposed priority SID policies for Costa Rica is the development of consultancy capabilities for support activities to CONEIA and for Environmental Impact Studies (EISs).

According to the recently approved Decree 23790, entitled "Regulations on Environmental Impact Studies", consultants have a number of opportunities for action within the EIA procedure. These include the following: support to CONEIA on the preparation of guidelines and EIS review, and to project proponents by undertaking the environmental impact studies on their behalf.

Whereas expertise is available in Costa Rica for undertaking some types of EISs, particularly for mining and hydrocarbon projects, there is an urgent need for upgrading consultancy firms to a level where they can assist CONEIA in the development of procedures and guidelines and, indeed, for reviewing EISs on its behalf. Initially, CONEIA may have to rely on the services of foreign consultancy companies, but it should ensure that there is an effective transfer of expertise to national specialists in this field.

2. General objective

To strengthen the capabilities of Costa Rican independent consultants and consultancy firms in the various SID areas. These include Environmental Impact Assessment, auditing, green design and re-design, competitiveness and sustainability, awareness building and training in SID.

3. Specific objectives

1. To develop the capabilities of national consultants in the preparation of EIA procedures, guidelines and questionnaires, for EIS review on behalf of CONEIA; and for the preparation of EISs on behalf of project proponents according to the recently approved Decree 23790, "Regulations on Environmental Impact Studies".
2. To develop consultancy capabilities on design and re-design of green equipment and installations, and on environmental and material efficiency auditing.
3. To enhance the ability of consultants to train individual industries and sectoral institutions on the benefits of a preventive and resource efficient approach.
4. To create and strengthen awareness on the part of local management consultants in the area of SID, in order for them to incorporate the concept into their support services to industry.

4. Implementation path

Environmental Impact Assessment

It will be necessary to empower local consultants to provide services to the National Commission for Environmental Impact Studies (CONEIA) as well as project proponents according to the requirements of Decree 23790 on Environmental Impact Studies. In this respect, CONEIA will require consultants to undertake the following:

- preparation of specific sections of the EIA procedure, such as consultation of public documents and participation of NGOs;
- preparation of guidelines for the formulation of the studies;
- undertaking EIS review on behalf of the Commission.

Project proponents generally involve consultants in the formulation of Environmental Impact Studies. The demand for EIA consultancy work has steadily increased as a result of the original EIA decree in 1992 and the new EIA regulations. In view of this situation, it is recommended to identify an independent organization which could liaise with independent consultants and consultancy firms to ensure the proper dissemination of

state of the art knowledge and technology in the field of Environmental Impact Assessment. Strengthening consultancy capabilities in EIA will comprise a number of activities such as training in EIA formulation and review, seminars to disseminate and develop the EIA regulatory instruments (regulations, guidelines, questionnaire), on-the-job training on EIS by forming joint Costa Rican and international teams. Such independent organization could support CONEIA by channeling international technical assistance to the individual consultancy companies, besides supporting them in a collective manner. Additionally, the Chamber of Consultants on Architecture and Engineering of Costa Rica (CCAI) could offer more technical support on EIS preparation.

Green design and re-design

In order to support consultants truly endeavoring to provide engineering services for sustainable design and redesign, industrial managers will likewise need to be educated about the complexity of customizing such services for each individual facility.

To consulting entrepreneurs (engineers and equipment suppliers), end-of-pipe controls are financially more attractive than customized green design services because they:

- can be more generic in design in comparison to what is required for process efficiency;
- involve large capital investments;
- require set-up and installation services; and
- may require periodic maintenance services and/or contractual operation services.

In comparison, process optimization services require careful, detailed study and analysis of the peculiarities of each industrial facility's unique set of circumstances. Unless industrial managers understand this, they will be unwilling to properly finance the consulting services for their facilities. Tangibles, such as expensive treatment equipment, are more easily understood expenses. While equipment may be used for pollution prevention, the main objective would be to optimize existing processes, supplementing them only as-needed and on a more process-by-process basis. On the other hand, facility modernization -- whereby major changes are made to replace obsolete, antiquated, grossly inefficient equipment with state-of-the-art clean technology -- can be a very expensive undertaking.

In summary, consultants wishing to effectively provide green design and redesign services need:

- access to information regarding a wide variety of alternative equipment, materials, procedures, etc. used to make processes more efficient, to recover materials from waste streams, etc.;
- the ability to acquire equipment in a timely and inexpensive manner for their clients; and
- awareness on the part of industrial managers and financial institutions of SID issues, particularly on the benefits of consultancy services to implement green design and redesign for clean technologies.

Auditing

Developing consultants capable of conducting SID audits -- plus appropriately applying the knowledge thereby gained -- is critical to the realization of clean technology objectives as described in Section 3.1. New requirements by MINSAL and CONEIA, for example, will necessitate new sorts of industrial behaviors and heightened levels of sustainable performance by industrial enterprises. Thus, this policy to strengthen consultant capabilities is essential in the short term as a means for achieving SID and is a complementary policy to those presented in Sections 4.1.1 and 4.1.2.

To enable consultants to conduct industrial facility audits for SID, critical skills include:

- an understanding of industrial process demands (i.e., industrial, chemical, and mechanical engineering);
- the ability to conduct a materials balance for a single production process as well as an entire facility; and
- the ability to generate technically and financially viable process or product redesign options for the audited facility to improve its resource use efficiency and waste minimization.

These skills can be developed through training. Accelerated development might be achieved through the transfer of experience by international SID auditors on joint industrial facility evaluation projects.

Training

At present, environmental consultancy services in Costa Rica are primarily focused on water pollution control, although some EIA studies are undertaken as well. On the road towards SID, consultancy services should be expanded to include pollution prevention, material-efficiency audits and clean technologies, and should also be able to provide training on such subjects.

Training industrial facilities and sectoral institutions to use a preventive and resource efficient approach would in fact provide further business opportunities to consultancy firms and may have a significant effect on increasing industrial awareness in sustainability issues.

Training is one of the most effective ways to strengthen consultancy capabilities. It should focus on the various aspects of consultancy services in Costa Rica, as follows:

- environmental impact assessment;
- auditing, green design and re-design;
- competitiveness and sustainability; and
- awareness building in SID.

An initial step in the development of training capabilities is to identify the need for training in the above areas. This is done by estimating the number of single environmental assessment events (EISs or audits) that would take place per year and the amount of consultancy work that may be required for green design and competitiveness.

The next step is identifying the types and quantity of training exercises required and then the likely number of trainers involved.

Management consultancy and sustainability

Apart from supporting specific SID-related consultancy services, it will be necessary to incorporate the different elements of SID in the services of local management consultancy firms, which are playing an increasingly important role in the process of industrial modernization:

- Strategic Planning efforts will have to incorporate a view on how a company will respond to the environmental challenges it will be facing in the future. Better still, they will contain plans on how a company will profit from environmental opportunities.
- Diversification efforts such as a Search for New Business Opportunities will take into account new business niches created by the "green wave".
- Quality upgrade programs along the lines of Total Quality Management (TQM) will incorporate the concept of environmental quality.
- Programs directed towards the establishment of strategic business alliances will take into account the environmental aspects of industrial cooperation.
- Bench marking efforts will have to incorporate efficiency objectives, minimization of resource use and environmental pollution, etc.

The demand for management consultancy services in Costa Rica is modest but on the rise, and it is considered quite feasible that these companies play a role in the introduction of SID. In general, it is considered that existing companies will in due time recognize the need to incorporate the concept of SID in their services or go under. In view of the rising demand for management consultancy services, entrepreneurship development programs may be set up in this field, in which the concept of SID is fully integrated.

Timing

The development of consultancy capabilities would initially involve external support, which could be provided in the short term as soon as the auspices of multilateral or bilateral institutions can be secured. Developing a critical mass of national consultants would take longer, through continuing external support and the gradual dissemination of knowledge and skills acquired. The latter may take two years or more.

Institutions involved

In order to estimate consultancy needs, the various Costa Rican institutions involved in SID work, such as MIRENEM, MINSAL and MICIT, should be consulted. The actual consultancy development could be carried out by an independent institution (e.g., CEGESTI) or a consultants' association such as CCAI.

Resources required

Most of the resources required would be in the form of external consultancy and direct support to host institutions. This may be provided by the same organizations which are supporting Costa Rican environmental agencies at present (such as GTZ, PAHO and BID in the case of MINSAL) or other multilateral or bilateral institutions, such as the Iberian

Cooperation Institute, which has previously provided excellent EIA training for the public and private sectors of Costa Rica.

5. Viability

There is a growing awareness on the part of the government and the private sector in Costa Rica of the important role of consultancy firms in industrial development. As an example, the Ministry of Science and Technology considers consultancy companies as one of the cornerstones of the competitiveness of the industrial base, and would be keen to promote programs directed towards the upgrading of these companies. It is hoped that thus a multiple effect of upgrading can be achieved among the end users of the services of the consultancy firms.

However, multilateral and bilateral development institutions, which form an important ingredient in the success of this policy, are often hesitant to provide assistance to private consultants. New mechanisms of cooperation may therefore have to be designed in order to achieve the desired creation and upgrading of the Costa Rican SID consultancy capacity. A mechanism which is considered feasible in this respect, is the establishment of business-to-business strategic alliances between consultancy firms in industrialized countries and local firms, in order to jointly explore the Costa Rican (and possibly Central American) markets. In the initial stage such cooperations may be financially and technically supported by international development organizations from the industrialized country, in the framework of export promotion programs for consultancy services.

4.1.4. Voluntary Corporate Code of Environmental Conduct

1. Introduction

In order to keep up with changing market conditions which increasingly require that products and services be provided in harmony with the environment, the implementation of a comprehensive legislative framework for Sustainable Industrial Development (SID) has become a matter of urgency. However, the introduction of such legislation can be a matter of years. Meanwhile, regulations which are being introduced in the country tend to respond to ad-hoc problems through mostly end-of pipe solutions, which typically can count on little support from the country's industrial base. As a result, it is widely felt that a more effective way to bring about SID is through a harmonious and step-by-step effort involving industry, the Government and support organizations. It is considered that a voluntary Corporate Code of Environmental Conduct may be an effective first step in this process. Such Code would be in line with AGENDA 21, which stipulates the following:

"Business and industry [] should ensure responsible and ethical management of products and processes from the point of view of health, safety and environmental aspects. Towards this end, business and industry should increase self-regulation, guided by appropriate codes, charters and initiatives integrated into all elements of business planning and decision-making, and fostering openness and dialogue with employees and the public."⁸

More importantly perhaps, a voluntary Code of Conduct would be in accordance with the preference of Costa Ricans to face challenges in a cooperative rather than in a confrontational manner. It is no wonder that, in the recent past, Voluntary Codes of Conduct for specific sub sectors of (agro) industry have become increasingly commonplace, with the "coffee agreement" between the Government and the coffee processors (see Annex IV) as a prime example. Also on the level of individual companies, more and more Voluntary Codes of Conduct are being adopted, a process in which subsidiaries of multinational play a leading role.

It would appear therefore that there is scope to come to an industry-wide Voluntary Code of Environmental Conduct, and the implications of such Code will be explored in more detail.

2. General objective

To promote sustainable and competitive entrepreneurship through a Voluntary Corporate Code of Environmental Conduct.

⁸ AGENDA 21: Business and Industry, Program area: Responsible entrepreneurship, par. 30.26.

3. Specific objectives

- To provide a low-threshold opportunity to Costa Rican companies to commit themselves to environmental protection through a Corporate Code of Environmental Conduct.
- To sign up a critical mass of at least 50 companies during the first five years of operation of the Code.
- To achieve tangible improvements in the environmental record of the signatory companies, as well as a demonstration effect towards other industrial enterprises in the country.
- To stimulate dialogue and cooperation between industry, the Government and special interest groups on the issue of SID.
- To contribute to the formulation of a comprehensive set of SID parameters which will be used to describe the environmental record of the signatory company throughout its lifetime.
- To provide a stepping stone towards future comprehensive SID legislation.
- To promote transparency on the part of the industrial community concerning its environmental record.

4. Implementation path

Components

Tentatively, a system of a Corporate Code of Environmental Conduct (CCEC) in Costa Rica would consist of the following components:

- A general CCEC for the entire Costa Rican industrial base, regardless of sectoral and size differences. This CCEC may change over time in accordance with the evolution of SID. The general CCEC may be complemented by specific Codes of Conduct at the sub sectoral or even company level, but these would be administered by the companies themselves.
- An annual reporting format for signatory companies (this report will also have to be filled out before signing up and will serve as a basis for the decision on whether or not to admit the company as a signatory). The annual reporting format will have to be based on the concepts of Sustainable Industrial Development plus the requirements of the different organizations involved in environmental protection in industry. It is in this phase that the system of a voluntary CCEC can make a contribution to the formulation of a comprehensive set of SID parameters for industry.
- A capacity to report, on an annual basis, the environmental performance of the pool of signatory companies as a whole and that of the individual companies. The companies will be able to use this report as part of their marketing efforts.

- A capacity to promote the CCEC in the industrial community in Costa Rica. It is envisaged that the need for promotion will diminish over time, as the Code will gain acceptance and prestige.
- A financial and technical capacity for improving the environmental performance of signatory companies. Ideally, signatory companies are awarded a certain amount of consultancy support, on a cost sharing basis, to provide them with an additional incentive to produce or provide services in accordance with the CCEC.

The implementation of the Code will have to be preceded by an investigation into the exact conditions of its implementation. This study may include, among other issues, the following:

- An investigation into the scope of existing Corporate Codes of Environmental Conduct in selected countries (for instance, the CERES principles in the US and the upcoming ISO directives for environmental management). The possibility of adapting a foreign Code to Costa Rican conditions may be contemplated.
- An investigation into experiences in other countries concerning the introduction and management of a voluntary CCEC. Some issues to be addressed include:
 - The role of a voluntary Code of Conduct complementary to Government regulations and enforcement
 - Possible synergies between a voluntary CCEC and efforts in the area of eco-labeling of products and services
 - Mechanisms to involve key interest groups in the administration of the Code (such as the industrial base, the environmental community, the investment community, government, etc.)
 - The nature of the organization which will administer the Code. Apart from the continuous promotion of the Corporate Code among the industrial community, this organization will take care of monitoring (either actively through inspections or passively through obligatory reporting), analysis of the data obtained and periodic publication of environmental records of the signatories. It will also have to stay abreast of new developments in fields such as low- and non-waste technologies, recycling, etc., and update the Code when necessary.
 - The question of internal or external compliance auditing on the part of the companies.
 - The question whether the adherence to a CCEC can be linked up with easy access to financing.
 - Sources of financing for the continuous administration of the Code (e.g., industries, multilateral or bilateral aid organizations and/or the Government)

Time frame

The diagnosis of the environmental record of a sample of food processing industries has indicated that it is highly probable that a significant pool of forward looking companies in

Costa Rica can be identified which are willing to subscribe, on a voluntary basis, to an Environmental Code of Conduct. Therefore, it is recommended to bypass the stage of a feasibility study and start with immediate effect a combined effort of sorting out the exact conditions under which a Code may be implemented, followed by its implementation itself. It should be stressed that the effective implementation of a CCEC requires a long term commitment on the part of the administering organization and the possible donor organization(s). Although the CCEC will serve as a stepping stone for future comprehensive SID legislation, it is envisaged that it will continue to be an important tool for exploring new ground in environmental protection in industry, even after the adoption of such legislation.

Organizations involved

It is recommended that the CCEC be administered by an existing or newly to be created independent organization with the following characteristics:

1. It should be completely impartial, while maintaining strong relationships with all players involved;
2. It should have the capacity to promote the Code, evaluate and monitor the environmental performance of companies and publish the results of the Code on a regular basis;
3. It should be able to attract financial resources to administer the Code and organize technical support to the signatory companies.

The effective implementation of the Code will require support from industry, the Government and support organizations:

- The active backing of the Chamber of Industries as well as sub sectoral organizations such as the Chamber of Food Industries and the Chamber of Technology-based Enterprises is considered essential for the widespread acceptance of the Code. This supporting role may consist of promotion activities for the Code among members and publishing on the progress of the implementation of the Code.
- In order for the Code to truly lead up to comprehensive SID legislation, all governmental agencies involved in environmental protection in industry should be involved in its incipience and should be regularly consulted thereafter.
- Support organizations such as international development agencies have an important role to play, both in terms of technical assistance (especially if a foreign Code is adapted to Costa Rican conditions) and in terms of financial support.

Costs and financing

An initial and rough estimate of the costs associated with the creation of a Corporate Code of Environmental Conduct is US \$ 125,000, including the preparatory study, the formulation of the CCEC and its reporting format, a promotion campaign and the signing up of the first group of companies. The administration of the Code for a period of five years may then take another US \$ 125,000, assuming that an existing organization is put in charge of this and that the progress of the companies is evaluated through an internal auditing procedure. While the financing of the creation of the Code will have to come

entirely from aid organizations, the costs of administering the Code may be covered through a 20%-80% cost sharing effort between the industries involved and (international) development organizations. Assuming an average of 25 signatory companies during the first five years, the average contribution per company will amount to US \$ 200 per year. This is considered feasible for an initial group of environment minded medium and big size companies. As the reputation of the Code becomes more solid, an annual contribution of US \$ 200 may be feasible for a wider group of companies as well. Of course there will be significant differences between the contributions of companies, in accordance with their annual sales figures.

Although consultancy support is considered an integral part of the CCEC, its costs should be covered on a cost sharing basis through additional funds from industry and support organizations.

5. Expected results

- A significant and measurable improvement of the environmental record of the initial group of fifty signatory companies, which will serve as role models for environmental protection in industry.
- A voluntary Corporate Code of Environmental Conduct, especially designed for the Costa Rican (and Central American) industrial environment, with the support of industry, government and special interest groups in Costa Rica.
- A validated reporting format for the environmental performance of the signatory companies.
- A widespread awareness among the industrial community in Costa Rica on the importance and potential benefits of a CCEC.

6. Viability

Considering the strong interest on the part of a number of forward looking industrial enterprises in Costa Rica in any kind of formal recognition of their efforts to protect the environment, the gradual introduction of a Voluntary Code of Environmental Conduct as described in this section is considered quite feasible. On the part of international cooperation agencies, there is a strong interest to focus on Sustainable Development in Industry, and a Code of Conduct can be seen as a very innovative and visible project to be involved in.

4.1.5. Subsidies and soft loans for clean and/or more efficient technologies

1. Introduction

The creation of an environmentally friendly company based on the use of clean technologies, or the adoption of cleaner and more efficient technologies on the part of an existing company, may yield environmental benefits that stretch far beyond the perimeters of the companies. As a consequence, it can be argued that society should share the financial burden of introducing these technologies through a system of soft credits or even subsidies, depending on the profitability of the changes. In situations where an entrepreneur will have to make a choice between, for example, an expansion of the production capacity of the plant or the introduction of low waste processing equipment, the availability of financial support may make the balance shift in favor of the latter.

There are additional arguments in favor of a system of financial support mechanisms for clean technology innovations in industry. More often than not, potential entrepreneurs planning to build a company around a sustainable practice such as recycling, or existing companies which plan to implement clean technology changes, do not possess the tangible guarantees which conventional financing institutions are looking for. However risky these endeavors may be perceived, they often prove profitable, both in economic and environmental terms. They clearly require a financing mechanism which is compatible with their innovative character.

The existing record of science and technology funding in Costa Rica is not very favorable. Some of the problems which have limited the effectiveness of such funds have been the following:

1. The traditional guarantee requirements have not been compatible with the lack of collateral on the part of the technology-based entrepreneurs and enterprises;
2. The funds, which in most cases have been a combination of resources from multilateral lending institutions and the Government of Costa Rica, have been administered by and through the government, which has resulted in (i) complicated and long application procedures; and (ii) the lack of governmental counterpart resources.
3. The funds have not been widely and efficiently promoted. One of the consequences of this has been that the funds have hardly been used outside the Central Valley.
4. The follow-up on the investments made have been limited to collecting the interest and principal.

There is a growing interest on the part of local financing institutions and international development organizations in the financing of technology-based initiatives, particularly those with a benefit to the environment. An initiative which is already in motion is that of a private foundation named Environmental Enterprises Assistance Fund (EEAF), a Washington D.C. based organization which invests between US \$ 100,000 and 300,000 in

environmentally friendly enterprises⁹ in Costa Rica through its local subsidiary. The investment vehicle applied in this case is a loan with a net profitability objective of 12%, which may then be converted into a private stock participation with a 20% ROI objective. It may be too early to tell whether the EEAF model will be successful in Costa Rica, but it is certainly a sign that new ways are being explored to fund private sector initiatives with a benefit to the environment.

Appropriate funding mechanisms for clean technology and efficiency initiatives are considered one of the priority issues in the pursuit of Sustainable Industrial Development. The following is a proposal for a set of two financing mechanisms which jointly are expected to cover the current needs for clean technology and efficiency funding in Costa Rica. It is important to mention at this point that the design of the Funds for clean technology innovation and efficiency programs has largely been based on financing mechanisms for the sustainable use of natural resources through technology innovations, as proposed to the World Bank by the Center of Technology Management in November 1994. As a result, this particular policy option will be explored in greater detail than the previous ones, which does however not imply that the SID team considers it of a higher priority.

2. General objective

To offer financial, technical and administrative support to the sustainable modernization of the industrial base in Costa Rica.

3. Specific objectives

1. To create an appropriate financing mechanism for private and public sector initiatives directed toward the implementation of the principles of Sustainable Industrial Development, such as the application of clean technologies¹⁰ and efficiency improvements.
2. To complement the investments with technical and administrative support in order to diminish the risk of failure, while at the same time strengthening the local capacity for consultancy support.
3. To join forces with other sources of financing in order for the fund to have a multiple impact.
4. To strengthen the competitiveness of the investment objects through the promotion of (international) industrial cooperation.

⁹ In the case of EEAF, "environmentally friendly enterprises" include, among others, projects in the area of energy efficiency, renewable energy, ecotourism, sustainable agriculture and forestry, recycling and pollution reduction.

¹⁰ The concept of "Clean technology" will be defined as having three complementary purposes: (a) less pollution discharged into the natural environment (water, air and soil); (b) less waste generated; and (c) less demand on natural resources (water, energy and raw materials).

4. Implementation path

Components

In the design of a financing mechanism for clean technology and efficiency initiatives in industry, a distinction has been made between pre-commercial projects¹¹ and projects which will be commercially viable in the foreseeable future. It is proposed that the pre-commercial projects will be supported through non-reimbursable subsidies, whereas the commercial undertakings will receive soft credits with a prolonged pay-back period¹² as well as a grace period. The two funds will be referred to as Funds for Sustainable Technology Innovation - FSTI/1 and FSTI/2, respectively.

The financing and support mechanisms as well as the suggested size of the Funds described below are based, among others, on the following:

- The track record of existing and former funds for technology-based and environmentally friendly initiatives in Costa Rica.
- The estimated demand for financing of clean technology and efficiency initiatives in the Costa Rican industry during the coming years.
- Experiences with similar funds in other countries, notably the National Fund for Technological and Productive Development in Chile (FONTEC) and the program for Industry and Environment (MILIEV) of the Netherlands.
- The traditional concept of Venture Capital financing as developed in the United States, in which high risk/high yield financing is coupled with an intensive monitoring and support program on the part of the administering organization. Important lessons to be learned from the concept of Venture Capital financing are that (i) a key to success of technology-based industrial initiatives is an intensive administrative and technical nurturing effort in the initial growth phase, and (ii) in order to effectively be able to provide this support, one needs a critical mass of available resources, which in the case of Costa Rica may partially be offset through grant money from international development organizations.

It is proposed that both FSTI/1 and FSTI/2 be administered by one Board of Directors, in which the government is represented by the Ministry of Economy, Industry and Commerce, the Ministry of Science and Technology and the Sectoral Council on Sustainable Development; the industry through the Chamber of Industries and the Chamber of Technology-based Enterprises; and the academic sector by the University of

¹¹ For the purpose of this document, pre-commercial projects cover the entire spectrum between Research and Development activities and the establishment of prototypes and pilot facilities, if and when they are directed toward the introduction of significant improvements in a product line or a production process, or the introduction of a new product or process.

¹² It may be questioned at this point whether commercially viable projects should not be financed through conventional bank loans; however, the experience is that this does not materialize because of (i) a lack of collateral on the part of the enterprise; and (ii) a lack of priority on the part of the enterprise, in a sense that in case a loan is made available, it would be used to finance initiatives unrelated to SID.

Costa Rica and the National University of Heredia. Representatives of the three sectors may rotate so that the Board of Directors will consist of three members at any given time.

The day to day running of the funds will be in the hands of an organization which will be referred to as the Management Firm. This will ideally be a unit in an existing independent (public or private) organization involved in financial and technical support activities for competitiveness and sustainability in industry.

Figure 6 shows the proposed structure of the Funds, which will be explained more in detail below.

Fund for Sustainable Technology Innovation Pre-commercial projects - FSTI/1
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Objective: The objective of FSTI/1 is to provide cofinancing in the form of subsidies, as well as technical and administrative support, to pre-commercial clean technology and efficiency initiatives in the Costa Rican industry.

Goal: To invest, over a period of five years, an average of the equivalent of US \$ 30,000 in 50 pre-commercial projects (up to a total of US \$ 1.5 million), 25 of which successfully reach their commercial phase within two years.

Eligible entities: All producers of goods or services, be it individuals, companies or consortiums of companies, which, in the opinion of the managers of the Fund, possess adequate technical, administrative and financial capabilities to turn the project into a success and commercialize its results.

Eligible projects: All projects which incorporate the following characteristics:

- They are directed towards investigating, adapting and developing product, process or equipment technologies, with a view to build a commercially viable business in the future or strengthen an existing business by adding a competitive and sustainable component.
- They are based on the implementation of clean technology and/or efficiency programs, with a view to promote Sustainable Industrial Development through the reduction, reuse or recycling of waste, a reduction of the use of materials and energy, a switch to renewable sources of energy, etc.¹³
- They belong to one of the following economic sectors: (i) Industry; (ii) Agro industry; (iii) Energy supply; (iv) Biodiversity, biotechnology and bioengineering.

¹³ So called "end of pipe" solutions to environmental problems may be financed in isolated cases but are not among the priorities of the Fund.

- They are described adequately in a Business Plan which includes profitability projections for the commercial phase of the project.
- The pre-commercial phase of the project is in itself not commercially viable.
- By the time the entrepreneur applies for financial support from FSTI/1, adequate financing arrangements will have to be made for the remainder of the investment.
- The projected ROI in US dollars of the commercial phase of the project is at least 12%.
- The duration of the pre-commercial phase is no longer than two years.

Benefits:

In case a project is cofinanced, the following package of benefits is awarded:

- A non reimbursable subsidy of 30% of the total costs of the pre-commercial phase of the project, with a minimum of the equivalent of US \$ 6,000 and a maximum of US \$ 45,000¹⁴.
- Additionally, the right to consultancy support in the formulation of a "bankable" Business Plan and the negotiation of funds from FSTI/1, the costs of which will not exceed US \$ 4,500 or 3% of the total cost of the pre-commercial phase of the project. The applicant will be free to choose from a list of private (and possibly public) local consultancy firms which have been approved by the Management Firm¹⁵. In case the Business Plan is approved for financing, the consultancy fee will be paid directly to the consultancy company by the Management Firm.
- Additionally, the right to technical and/or administrative local consultancy support for the duration of the project, that is, for a maximum of two years, for up to 7% of the costs of the project with a maximum of the equivalent of US \$ 10,500. Again this contribution will be paid out directly to consultancy firms which have been approved by the Management Firm.
- Technical and administrative follow-up by the Management Firm.

¹⁴ In specific cases, a group of small projects can be financed through a coordinating entity, which would then have the same rights and responsibilities as the companies which are financed directly. In this case, technical and administrative support could be offered in a collective manner.

¹⁵ The applicant may also suggest to contract the services of a national consultancy company which is not in the list of approved companies. In that case, the Management Firm will evaluate the consultancy company for possible approval.

When the project finishes, the recipient company obtains the exclusive rights to its results.

Management of resources:

FSTI/1 will disburse the approved funds according to the completion of the different stages of the pre-commercial project. The administration of the resources is the responsibility of the recipient, who, in order to comply with the provisions in the "Execution Agreement" between FSTI/1 and the recipient, will hand over tangible guarantees such as mortgages and bank guarantees. These guarantees may be fragmented in both amount and time, in accordance with the different stages of the pre-commercial project. The guarantee documents will be returned upon reception of progress reports from the recipient of the subsidy.

Channeling of the disbursements:

All disbursements will be channeled through a bank which:

- (i) will administer the passive resources, maximizing the yield while assuring their availability for disbursement;
- (ii) will disburse the funds according to the directions of the Management Firm.

Incentives:

In view of the slow allocation of resources in past and existing funds for technology-based initiatives in Costa Rica, it is considered highly desirable that proper incentives be designed for the day-to-day managers of the fund. It is therefore tentatively proposed to make a reservation at the time of disbursement of a subsidy of 3% of the total value of the project (up to a maximum of US \$ 1,350), which will be paid out collectively to the Fund's managers in case the project successfully completes its first year of operation.

Fund for Sustainable Technology Innovation Commercial projects - FSTI/2
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Objective:

The objective of FSTI/2 is to provide cofinancing in the form of soft loans, as well as technical and administrative support, to commercial clean technology and efficiency initiatives in the Costa Rican industry.

Goal:

To invest, over a period of five years and in a profitable manner, an average of the equivalent of US \$ 180,000 in 30 commercial projects (up to a total of US \$ 5,4 million).

Eligible entities:

All producers of goods or services, be it individuals, companies or consortiums of companies, which, in the opinion of the managers of

the Fund, possess adequate technical, administrative and financial capabilities to turn the project into a commercial success.

Eligible projects:

All projects which incorporate the following characteristics:

- They are directed towards the application of clean and/or more efficient technologies, through the reduction, reuse or recycling of waste, a reduction of the use of materials and energy, a switch to renewable sources of energy, etc., with a view to build a commercially viable business or strengthen an existing business by adding a competitive and sustainable component.
- They belong to one of the following economic sectors: (i) Industry; (ii) Agro industry; (iii) Energy supply; (iv) Biodiversity, biotechnology and bioengineering.
- They are described adequately in a Business Plan.
- The Business Plan shows that the project has a pay-back period of four years or less.
- By the time the entrepreneur applies for financial support from FSTI/2, adequate financing arrangements will have to be made for the balance of the investment.

Benefits:

In case a project is cofinanced, the following package of benefits is awarded:

- A loan with a pay back period of 12 years, a grace period of up to four years and an interest rate equal to the passive rate of the Central Bank of Costa Rica minus 5%. The cofinancing will not exceed 70% of the total project costs, with a minimum of US \$ 50,000 and a maximum of US \$ 500,000¹⁶.
- Additionally, the right to consultancy support in the formulation of a "bankable" Business Plan and in the negotiations with FSTI/2, the costs of which will not exceed US \$ 10,000 or 3% of the total cost of the project. The applicant will be free to choose from a list of private (and possibly public) local consultancy firms which have been approved by the Management Firm¹⁷. In case the Business Plan is approved for financing, the consultancy fee will be paid directly to the consultancy company by the Management Firm.

¹⁶ In specific cases, a group of small projects can be financed through a coordinating entity, which would then have the same rights and responsibilities as the companies which are financed directly. In this case, technical and administrative support could be offered in a collective manner.

¹⁷ The applicant may also suggest to contract the services of a national consultancy company which is not in the list of approved companies. In that case, the Management Firm will evaluate the consultancy company for possible approval.

- Additionally, the right to technical and/or administrative local consultancy support for a maximum of four years, for up to 5% of the costs of the project with a maximum of the equivalent of US \$ 20,000. Again this contribution will be paid out directly to consultancy firms which have been approved by the Management Firm.
- Technical and administrative follow-up by the Management Firm.

When the project finishes, the recipient company obtains the exclusive rights to its results.

Guarantees:

The preferred guarantees will be mortgages, bank guarantees etc. However, up to a value of 50% of the loan, technological guarantees will be accepted such as patents, software and electronic diagrams. In case technological guarantees are used to back up a loan application, the applicant turns over the rights to the commercial exploitation of the technological development to the Management Firm through a signed agreement. In turn, the Management Firm signs a non-disclosure agreement for the duration of the loan.¹⁸

Management of resources:

FSTI/2 will disburse the approved funds according to the completion of the different stages of the pre-commercial project through a so called FIDEICOMISO, to be established in a Costa Rican bank. The bank will (i) administer the passive resources, maximizing the yield while assuring their availability for disbursement, (ii) disburse credits upon request of the Management Firm; and (iii) collect the payments of interest and principal. The bank will have a right to a commission on the generated interest.

Incentives:

It is again considered highly desirable that proper incentives be designed for the day-to-day managers of the fund. In the case of FSTI/2, it is tentatively proposed to make a reservation at the time of disbursement of a subsidy of 1,5% of the total value of the project (up to a maximum of US \$ 3,000), which will be paid out collectively to the Fund's managers in case the project successfully completes its first year of operation.

¹⁸ As an alternative to this mechanism, a separate Loan Guarantee Fund may be set up. However, it is recommended to maintain the concept of technological guarantees as an integral component of the credit facility, as it is considered fundamental for the development of technology-based enterprises in Costa Rica.

Time frame

The duration of the active management of FSTI/1 and FSTI/2 will be five years, and should be initiated as soon as practicable for a number of reasons, the most important one being that existing initiatives for the exploitation of clean and/or more efficient technologies in industry, agro industry, energy supply and biodiversity have virtually no access to suitable sources of financing. Besides, existing funds for the financing of technology-based initiatives such as FORINVES and FODETEC of the Council for Scientific and Technological Research have recently been discontinued. It is widely felt that there is an urgent need for new financing facilities for technology-based initiatives, with provisions that are in accordance with new insights in the specific financial needs of these companies as well as considerations of sustainability.

Organizations involved

The above described financing mechanisms have been developed by the Technology Management Center of Costa Rica, in close consultation with the Ministry of Science and Technology of Costa Rica (MICIT) and the Ministry of Economy, Industry and Commerce (MEIC), as well as representatives of the World Bank and the Costa Rican Biodiversity Institute (INBio). Interestingly, it is the explicit opinion of MICIT to limit the participation of the Costa Rican Government to a participation in the Board of Directors of the Funds, alongside with representatives of the private and academic sectors.

As described earlier, it is recommended to leave the day-to-day management of the Funds in the hands of a unit (the "Management Firm") in an existing independent (public or private) organization involved in support activities for competitiveness and sustainability in industry. One of the fundamental tasks of the Management Firm will be to establish cooperation with:

1. Other private sector financing institutions, such as banks and national and international development organizations. This will be an effective way to leverage the financial and technical support capabilities of the Funds in the case of individual private sector financing, and may assure the continuity of the Funds through the attraction of additional resources;
2. Sectoral support organizations, such as Chambers of the different industrial sub sectors, which could accelerate the promotion of the Funds.
3. Regional support organizations which will also be able to ease the promotion of the Funds. Special efforts will have to be made to establish links with support networks outside the Central Valley.
4. Private and public consultancy firms. During the first year of the operation of the Fund, a data base of consultancy companies is set up which could offer technical and administrative support. Especially the list of technical support entities will have to be updated continuously thereafter.

It is envisaged that each of the organizations mentioned could act as an accelerator in the operation of the Fund.

Costs and financing

The following is an approximation of the expenditures during the first five years of the above described Funds FSTI/1 and FSTI/2. The interest payments on the FSTI/2 loans, which will start by year 5 at the latest, have not been taken into account. The size of the two Funds can be adjusted according to the demand for financing and the availability of resources; however, the smaller the size of the Funds, the more expensive its management will be in relative terms.

(amounts in 1,000 US \$)

Year →	1	2	3	4	5	Total
Administration of the Funds	100	100	100	100	100	500
FITS/1						
Subsidies to enterprises	200	250	300	350	400	1500
Business Plan support (utilization 60% ¹⁹)	9	18	18	18	18	81
Technical and administrative support (utilization 60%)	24	36	48	60	70	238
Incentives for Fund Managers (utilization 60%)	0	3	5	7	9	24
FITS/2						
Loans	720	900	1080	1260	1440	5400
Business Plan support (utilization 40%)	10	30	40	30	10	120
Technical and administrative support (utilization 60%)	36	54	72	90	108	360
Incentives for Fund Managers (utilization 60%)	0	8	12	15	19	54
TOTAL in 1,000 US \$	1099	1399	1675	1930	2174	8277

Total credits	5,400,000
Total grant money	2,877,000
Total expenditures first five years.....	US \$ 8,277,000

5. Expected results

The main results of the operation of the Funds for Sustainable Technology Innovation are expected to be:

1. The successful completion of at least 25 pre-commercial projects, as well as the start of their commercial implementation, in the area of clean and/or more efficient technologies.

¹⁹ It is assumed that the overall utilization of this service will be 60%, because not all beneficiaries of FSTI/1 will need support in the formulation of their Business Plan.

2. The successful start of approximately 30 commercial ventures (either as part of an existing entity or as a new company) based on clean technology and/or efficiency innovations.
3. The creation of a significant amount of high quality and sustainable employment opportunities.
4. The creation of an innovative financing mechanism in Costa Rica, run by an independent entity and incorporating technical and administrative support to the beneficiaries as well as incentive schemes for the Fund managers.

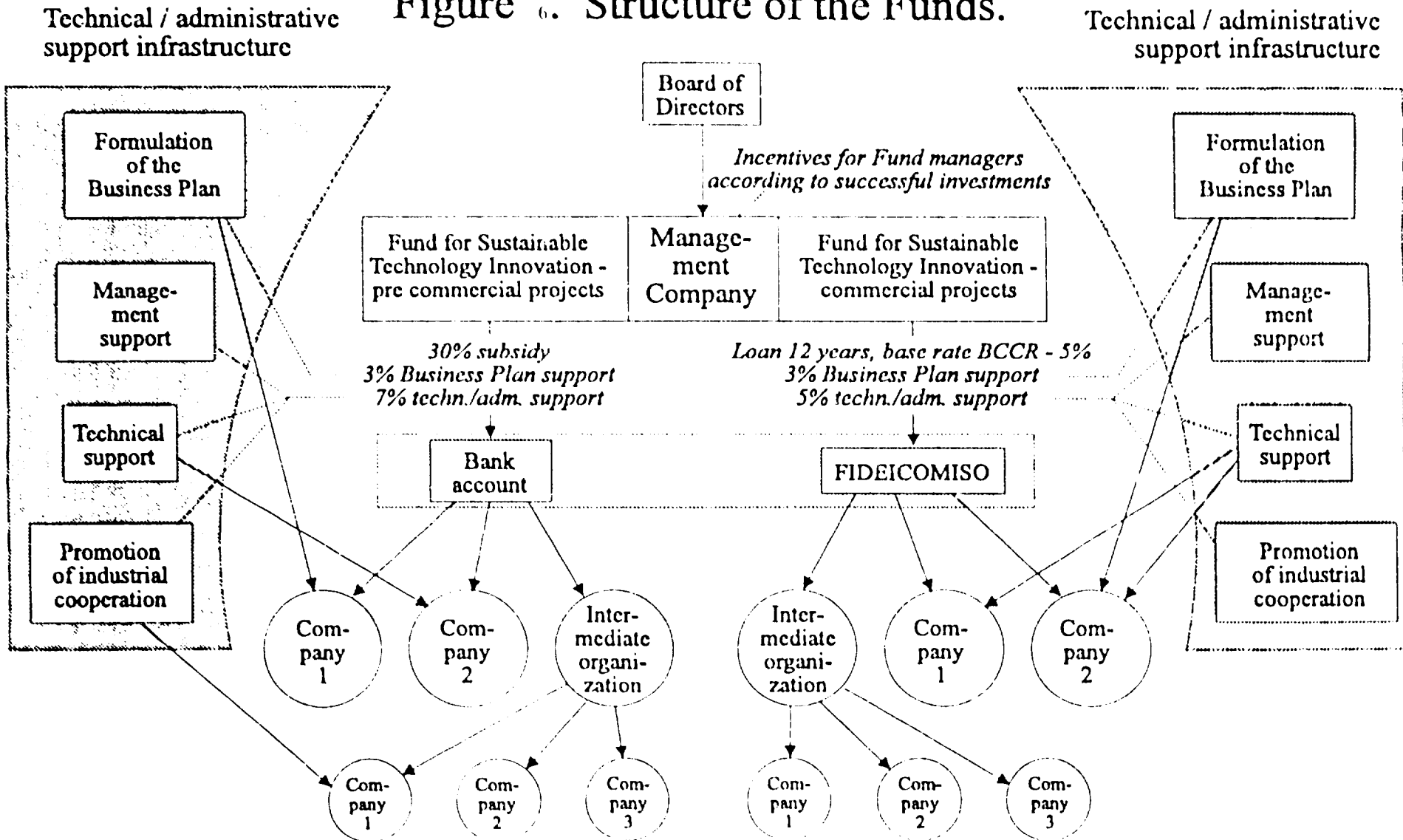
6. Viability

In the design of mechanisms for private sector financing, it is important to take into account that Costa Rica has reached a level of development at which it no longer has access to "cheap" monetary resources from institutions such as the World Bank and the Inter American Development Bank. As an example, it is no longer considered feasible to negotiate funds which can be loaned to the private sector at the passive rate of the Central Bank of Costa Rica minus five per cent, as was formerly the case with the CONICIT/FODETEC funds. A complicating factor in this respect is the fact that Funds which have already been negotiated with multilateral lending institutions are heavily under utilized because of lengthy ratification procedures and the lack of counterpart resources.

On the other hand, the public and private banking sector in Costa Rica can still be described as traditional and risk averse, and therefore incompatible with the financing needs of the mostly technology based enterprises wishing to exploit business opportunities in the area of Sustainable Industrial Development. Attempts to create mechanisms for risk financing in the country have so far been frustrated by the lack of local experience in the field of investment banking and the virtual absence of private stock trading, among other factors.

Nevertheless, business opportunities in Costa Rica in the field of Sustainable Development are emerging every day, and there is a growing consensus between Government, the private sector and donor agencies that the effective exploitation of these opportunities could be a determining factor for the competitiveness of the private sector in the future, not to mention the sustainable development of the country as a whole. As a further preparation for the establishment of a Fund as described above, it will be necessary to map the demand for financing in more detail, ideally to the point that an investment portfolio is established for the first years of operation. Once such information becomes available, it is considered highly feasible that bilateral donor agencies enter in a financing scheme such as FSTI/1 and FSTI/2, providing resources at the "cheap" rate necessary for the enterprises involved as a reflection of the shared responsibility between industry and society for environmentally benign private endeavors.

Figure 6. Structure of the Funds.



4.2. SID projects for the food processing industrial subsector

4.2.1 Introduction

The overall emphasis of SID options for the food processing industrial sub-sector is upon the efficient use of all materials entering production facilities and on the minimization of wastes generated in connection with manufacturing activities. The policy recommended in Section 4.1.3 for strengthening of multimedia, clean technology consultancy services will be especially important to the realization of these efficiency goals. Properly structured soft credits and subsidies, as described in Section 4.1.5, can help to promote the waste reuse and recycling enterprises suggested by SID options presented in Sections 4.2.3 and 4.2.4. Furthermore, preliminary options presented for green redesign and/or provision of green services to the food processing sector focus on low cost, low technology modifications to current operations rather than major restructuring of facilities.

Changes taking place within a facility must usually be custom evaluated and crafted. The combination of technical, procedural, material, and financial parameters varies so much from facility to facility that it is rare that the beneficial and viable options for one facility are the same as those for another, at least in terms of new equipment installation, equipment redesign, etc. Nevertheless, one broadly applicable, basic technology for more efficient water use has been identified and is suggested for implementation below (and elaborated upon in Attachment XI).

With respect to the timing of SID activities, several options for water use modification are amenable to immediate implementation by enterprises. The issues of solid waste management and especially packaging reduction or recycling require much more detailed study, to identify viable options for integrating internal facility operations with products, services, and customer behavior external to the facility. Thus, these issues will take longer to resolve, perhaps into the medium and long terms.

4.2.2 Water use improvement

Water use and waste water generation can be reduced through the following relatively simple measures:

- Revised practices of cleaning equipment and floors including techniques such as:
 - first rinses (for collection of small quantities of highly concentrated waste waters); and
 - dry wipe prior to wet wash (for collection of dry solids).
- Improved control of water flow through the introduction of nozzles on the ends of water supply hoses. See Attachment XI for a more thorough discussion of this measure. The nozzle program proposed is believed to have significant potential for water savings and improved waste water generation management with minimal investment. It can be implemented with immediate effect.
- Redesign of floors and trenches to include features such as:
 - smooth surfaces for easy wash down;

- placement of drains and trenches in close proximity to equipment (or vice-versa);
- segregation of drains and trenches by waste type (although, given the fact that drains are generally below the surface of the floor, redesign to manage waste waters separately will not be readily accomplished. However, the design of new facilities or the expansion of existing facilities offer the opportunity to implement this measure); and
- improved sloping of floors and trenches to assist drainage with gravity rather than increased water use.

4.2.3 Organic solid waste management

Due to the types of organic wastes generated in food processing facilities as discussed in Section 2.3, it is assumed that opportunities for in-plant reuse of organic solid wastes are minimal.²⁰ The greater opportunity for more immediate pursuit involves reuse of such wastes outside of the generating facilities, probably as animal feed, soil supplements (composting), or fuels. However, the pursuit of these reuse opportunities requires:

- Collection of data about: what types of wastes are available, where, in what quantity, and when (e.g., daily or seasonally).
- Transfer of wastes from generators to reusers through:
 - arrangements between individual enterprises;
 - coordinated, centralized collection and delivery services; or
 - centralized transport services in association with intermediate processing.
- Identification of needs for and feasibility of modifying waste forms to suit reuse (e.g., dewatering of a wet waste, segregation of a mixed waste).

It will be unclear what reuse options will be viable until such information becomes available. For example, vegetable and animal fats, oils, and greases are organic solid wastes from food processing that are perhaps most difficult to manage for reuse. These wastes might be used in fat rendering to produce paraffins, waxes, and other materials useful in cosmetics, candles, and other products. To plan a rendering operation, one must know what waste inputs to expect. The more consistent the quality of fats received, the easier it is for renderers to operate their processes and to guarantee a particular quality output. Also, sufficient quantity is needed to make a rendering operation financially viable. Most fat generators in the food processing industry are likely to generate relatively small quantities of waste, perhaps as little as one drum per day. Such quantities are hardly worth transporting over any significant distance. And they cannot be stored on site for more than one day due to odor and bacterial problems. Daily pickup rounds might be organized to collect and deliver fatty wastes to a centralized rendering facility, but then the problem of waste composition variability becomes an issue. A complete study of these

²⁰ One clear exception to this applies to the dairy processing facilities, which produce cheese but do not yet make use of the whey (i.e., protein solids) in the liquid drained from the cheese-making process.

wastes might reveal whether the problems are manageable. If not, it may be worthwhile to consider other options such as use of the fats for fuel supplements to on-site boilers, etc.

Waste exchanges operating in Costa Rica include the following:

- University of Heredia, for a variety of waste types generated by industries located in San Antonio de Belén; and
- Chamber of Industries, for stable wastes only, and for which organic food wastes would not qualify.

4.2.4 Packaging

One of the most crucial elements of remedying the plastic packaging situation, either from the standpoint of reduced packaging or for recycling of waste packaging, is awareness building and education of the consumer.

Since it is doubtful that plastic packaging will be eliminated in the foreseeable future (e.g., replaced by improved cellulose packaging or new, biologically grown, "plastics"), recycling of packaging will be an issue even if more efficient packaging becomes available. Recycling will require the segregation of waste plastic from other household trash by the consumer and organized collection of recyclable plastics by municipalities.

Recycling of mixed, post-consumer plastic packaging has been successful in countries such as the United States. Technologies are reasonably well developed for a variety of extrusion and injection mold processes using recycled plastic.²¹ Thus, for Costa Rica, technological feasibility is perhaps the least obstacle to overcome. A collection system for waste plastic packaging is more crucial and complex to organize. In order to effectively design a collection and recycling system, the following information about plastic waste must be generated:

- how much can be collected and in what time frame?
- from where and by whom?
- of what condition and composition?
- what preprocessing is necessary: sorting, cutting, washing, grinding?

Also, markets for recycled plastic products must be developed in order to ensure the financial viability of plastic waste recycling.

Ways in which food processing enterprises can help with plastic recycling include:

- avoiding use of plastic packaging that is not easily recycled;
- agreeing to buy recycled-content plastic products produced in Costa Rica from domestic post-consumer plastic waste collection;
- seeking to minimize waste plastics generated by production processes; and
- for those in-facility plastic wastes that cannot be eliminated, arranging for their recycling to the extent possible.

²¹ Extrusion and injection mold equipment would need to be imported into Costa Rica for any plastic recycling endeavors, unless the equipment could be obtained used from a domestic source. Costs for simple, small scale extrusion systems begin at approximately US \$250,000. An injection molder alone can cost US \$500,000, with product molds and supporting equipment costing extra.

Attachment I.- Inter-Institutional Agreements

Agreements between organized entrepreneurs and state authorities have been used in Costa Rica to promote the commitment of the stakeholder with the improvement of the environmental situation of their plants.

Coffee Agreement

The first such agreement in the country was signed on 27 August 1992 by ICAFE on behalf of coffee producers and the Ministry of Health (MINSAL)/Acueductos y Alcantarillados (AyA)/Servicio Nacional de Electricidad (SNE) for the Government, with the President of Costa Rica as witness.

This agreement was signed as a result of (i) the significant pollution produced by the coffee industry; (ii) the fact that adequate know-how is available on the technologies for efficient utilization of resources and waste management; and (iii) the commitment of the coffee industry and the authorities to provide the means to improve the environmental record of this sector.

The signatories agreed to the following:

FIRST ICAFE and AyA shall monitor on a continuous basis the results of treatment, management and disposal of liquid and solid wastes from the coffee industries.

SECOND ICAFE and AyA shall provide assistance to MINSAL and SNE in order to minimize the use of water and to achieve an appropriate separation of solid waste. MINSAL and SNE shall supervise the application of the law in terms of environmental protection and control.

THIRD Prior to the approval of water use concessions to coffee industries, SNE shall require a study by ICAFE in relation to the use of water in the plant.

FOURTH For the approval of siting, construction and operation permits to coffee installations, MINSAL shall require that ICAFE and AyA certify that appropriate consideration is given to environmental protection.

FIFTH Application of the Action Plan approved by the signatories on 13 March 1992, according to the following schedule:

Period 1992-1993

1. Review and implementation in accordance with the legislative framework.
2. Measurement and reduction of water consumption through recirculation of water within the various stages of the process.
3. Establishment of efficient separation of pulp and water through treatment of washing water and an appropriate final process for the pulp.
4. Establishment of a single discharge for all the waste water streams within a coffee plant in order to facilitate waste control.

Period 1993-1994

1. Reduction by 50% of suspended solids in waste water and adequate disposal of treated sludge.

2. Implementation of dry pulping and dry transport of pulp.

Period 1994-1995

Introduction of anaerobic treatment of dissolved matter in order to reduce 80% of DQO, DBO and total solids.

SIXTH MINSAL shall be responsible for overseeing compliance of the Action Plan in accordance with the General Law of Health, through its Department of Environmental Control.

SEVENTH MINSAL shall establish environmental standards for the coffee sector in consultation with ICAFE and AyA. Such technical premises for the protection of the environment should be established within the three months after the signing of the agreement.

EIGHT ICAFE shall provide detailed technical recommendations to coffee plants to comply with the Action Plan, which is an integral part of the agreement.

Other Agreements

A similar agreement between pig farms and pork-meat processing plants, and relevant authorities is being prepared at present. This will be followed by an agreement on the environmental management and control of sugar mills.

Voluntary Plans

The Wildlife Law (*Ley General de Vida Silvestre*) prohibits releasing waste water to natural water bodies. Industries must therefore undertake treatment to avoid detrimental effects on wildlife. The deadline to comply with this requirement is December 1994.

As the above deadline is very near and very few industries have taken measures to comply with the law, the Costa Rican Chamber of Industries has developed a system of voluntary plans to help non-conforming plants to make proposals to the Ministry of Health to respond to the law in a gradual manner.

Under voluntary plans, industries may opt, with MINSAL's consent, to undertake preliminary studies and submit a plan by November setting up gradual targets to be accomplished according to the plants' technical and financial capabilities. In addition to end-of-pipe treatment, the plants may consider options to minimize the use of water and the production of waste water through the implementation of clean technologies and good-housekeeping measures.

The Chamber of Industries is supporting the development of a "Procedural Manual for the Food Industry" which provides advice on the various options for waste minimization and water consumption control. This manual will soon be available to all the industries concerned.

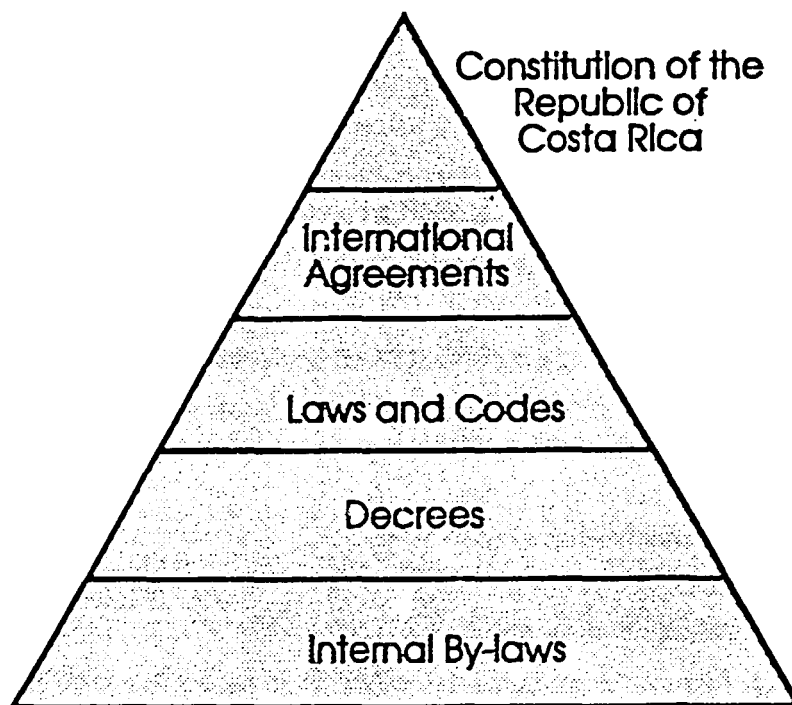
Award for Conservation Achievement

Another initiative by the Chamber of Industries is to give a prize to the industry with the greatest achievements for the conservation of the environment. The candidates are required to prove the development and application of innovative measures with significant positive impacts on the environment. Such award is expected to stimulate the research and development of clean technologies and measures to reduce consumption of natural resources.

Attachment II.- Overview of the Costa Rican Legal System concerning Sustainable Industrial Development

Legal System Structure

There are several kinds of regulations structured according to their hierarchical level, as follows:



Constitution of the Republic of Costa Rica: Approved on November 7, 1949, the Constitution is the highest level regulation. There is a High Court called The Constitutional Court IV, which makes sure that no lower level legislation is adopted that contradicts the Constitution.

International Agreements: When an international agreement is to be signed, the Parliament should ratify it. The procedure is:

- The Executive Body has to propose it by publishing it as a *project of law*, in the Government Publication "La Gaceta".
- This project must go through three different debates at the Parliament.
- After the third debate ratifies it, it is published again in La Gaceta but as a Law.

Laws and Codes: A law or a code have the same hierarchical level. At the time of their incipience, they are baptized either "Code" or "Law".

The procedure to approve a law or code is:

- Any citizen can propose a project of law, but it has to be supported by a Member of Parliament. The Executive Body can propose it as well.
- The project is assigned to a Parliamentary Commission to study it and make amendments if necessary. This Commission puts it on the Agenda of the Session of Parliament.
- The project is discussed at three different debates of the Session of Parliament.
- After the third debate approves it, it is sent to the President of the Republic to sign it.
- The President approves and signs it.
- If for any reason, the President does not agree with the proposed law, he can veto it. In this case he has to specify the reasons.
- The project comes back to the Parliament, which decides whether the the objections of the President are valid. The Parliament is in the right to recoin the law.
- If a law is finally approved, it is published in La Gaceta as a Law or a Code.

In case a law is closely related to a Ministry or a Governmental Institution, this organization would look after its implementation. Else, the Judicial Body will.

Decrees: In Costa Rica, Decrees are considered as "the way the Executive Body governs". Decrees can be by-laws pertaining to a specific law, or simply be any regulation in general.

The procedure to establish a decree is:

- A proposal is submitted by the head of a department of a specific Ministry or a interinstitutional commission to the Minister.
- The Minister meets with the President of the Republic and they both sign the decree.
- The Decree is published in La Gaceta.

The department that proposes the Decree is generally the one in charge of its implementation.

Internal By-laws: At the lowest hierarchical level, internal by-laws are rules for a Governmental Institution and organizations related to it. They are established by the Board of Directors during their session. The organization itself is responsible for their implementation.

Every part of this hierarchical structure has to be in harmony with its higher levels.

If any regulation is contradictory to the provisions of a regulation of a higher hierarchical level, it is declared unconstitutional and revoked.

Environmental Regulations in Costa Rica:

According to the nature of the contaminating agent that an industry can produce, the regulations are as follows:

1. General Environmental legislation

- Every person has the right to a healthy environment. (amendment to art. 50 of the Constitution of the Republic)
- Every person must contribute to the promotion and maintenance of artificial and natural environmental conditions. (Law of Health, art.262)
- The Interinstitutional Commission for the Environmental Impact Assessment was created to analyze, inspect, evaluate and approve (if it is the case), every mining, tourist, industrial, urban, electric power generation, agricultural or patrimonial zones project. (Decree N°21930 - MIRENEM)
- Project of the Basic Law of Environmental Protection and Sustainable Development Promotion states punishments to people who cause any environmental damage. (art.77)

2. Soil Contamination

Laws

- All solid waste must be separated, collected, accumulated and treated responsibly in such way as to avoid or diminish water, air or soil pollution. (Law of Health, art. 278)
- The recovery of solid waste should be done in a place authorized by the Health Ministry. This authorization lasts for one year at a time. (Law of Health, 284)
- Organizations that are harmful, unhealthy or uncomfortable for their workers or neighbourhood may be closed. (Law of Health, art 304)
- The Law of Urban Planification states that the National Plan of Urban Development must take as one of its main elements, the natural resources and forest reserves' rational use.

Decrees and by-laws

- The standards for waste handling (such as collection, transport and storage) are given in the Waste Handling By-law. This by-law also states that waste separation may be done at its origin or at places authorized by the Ministry of Health. (art. 57)

3. Liquid Contamination

Laws

- The Law for the Conservation of Forest Life prohibits releasing waste water to rivers, lakes, creeks, etc. Industries must have treatment of waste water to avoid any

contamination that may destroy forest life. Industries must comply with this regulation before November of 1994, as a two-year period of grace was granted. (art. 132)

- According to the Law of Health, the Health Ministry must control the distribution network for potable water, in order to ensure the water's quality. (art 268)
- The Law of Waters states that special concessions can be given to industries, although they have to warrant that the water released will not contaminate or cause fetidity.(art 276)
- All solid waste must be separated, collected, accumulated and treated responsibly in such way as to avoid or diminish water, air or soil pollution. (Law of Health, art. 278)
- The Law of Waters regulates the conservation and improvement of the aquatic resources, protecting basins, beds and origins of rivers.
- Any installation or plant that is close to water resources or water purification plants is forbidden. (General Law of Potable Water)
- The Forest Law declares protected zones along river beds (50 m wide), and aquatic basins (300 m to each side of its maximum depression).
- Law N°5438 creates the National Service of Subterranean Waters, which regulates the research, use and protection of subterranean waters. It states the necessary conditions to protect them against contamination.

Decrees

- Imports or transit of any products which may harm the health or life of the population are prohibited. (Decree N°18887-s)

4. Atmospheric/odor contamination

International Agreements

- The Agreement of the International Labour Organization (ILO) with Costa Rica states that national regulations must establish the necessary conditions that an industry must comply with in order to prevent any risk and protect workers. Although it controls noise, vibrations and air contamination, it does not define any standard levels.

Laws

- All solid waste must be separated, collected, accumulated and treated responsibly in such way as to avoid or diminish water, air or soil pollution. (Law of Health, art.278)
- The Law of Health prohibits any emission that contributes to atmospheric contamination, defined by this law as: its deterioration caused by contaminating agents (such as solid particles, dust, steam, gases, radioactive substances or smoke), or bad smells and sounds, that may jeopardize the well being of the people. (art 294)
- The establishment of commercial or industrial activities in buildings which do not have the necessary conditions to avoid atmospheric contamination is prohibited.(Law of Health, art. 297)

- Organizations that are harmful, unhealthy or uncomfortable for their workers or neighbourhood may be closed. (Law of Health, art 304)

Decrees

- The Decree N°1118 of 1970 states that motor vehicle owners must avoid carbon monoxide or smog venting, or any other kind of air contamination.

5. Noise contamination

International Agreements

- The ILO Agreement with Costa Rica states that national regulations must establish the necessary conditions that an industry must comply with in order to prevent any risk and protect workers. Although it controls noise, vibrations and air contamination, the document does not define any standard levels.

Laws

- The Law of Health prohibits any emission that contributes to atmospheric contamination, defined by this law as: its deterioration caused by contaminating agents (such as solid particles, dust, steam, gases, radioactive substances or smoke), or bad smells and sounds, that may jeopardize the well being of the people. (art 294)
- Organizations that are harmful, unhealthy or uncomfortable for their workers or neighbourhood may be closed. (Law of Health, art 304)

By-laws

- The Noise and Vibrations By-law defines the level of noise allowed inside and outside an industrial establishment.

6. Toxic or Dangerous Waste

International Agreements

- The Basilea Agreement is in the process of being ratified by the Parliament. It controls transborder transportation of dangerous waste and tends to eliminate it.

Laws

- It is not allowed to import, manipulate, store, transport or distribute any toxic substance without satisfying the regulations of the Ministry of Health. (Law of Health, art. 239).

By-laws

- The By-law of Toxic Substances Control states that every person that imports, manufactures, stores, sells, transports or distributes toxic substances must be registered at the Dept. of Toxic Substances and Work Medicine (at the Ministry of Health)

7. Human Resources

International Agreements

- The ILO Agreement with Costa Rica states that national regulations must establish the necessary conditions that an industry must comply with in order to prevent any risk and protect workers. This Agreement does not define any standard levels.
- Organizations that are harmful, unhealthy or uncomfortable for their workers or neighbourhood may be closed. (Law of Health, art 304)
- The Law of Labour Risks defines employers' liability pertaining to risks of employees (including accidents and illness). It also states the responsibility for the National Insurance Institute in case of an accident.

By-laws

- The Industrial Sanitation By-law classifies industries as: harmless, inconvenient, unhealthy and dangerous. It also regulates the localization for each of those.
- The General By-law of Industrial Safety and Sanitation states the minimum conditions that an industry must satisfy to protect its workers' comfort and safety.
- The Noise and Vibrations By-law defines the level of noise allowed inside and outside an industrial establishment.

Projects of law

- Every employer must ensure that the environmental conditions are such that the health and life of his employees are not in danger. (Project of the Basic Law of Environmental Protection and Sustainable Development Promotion, art. 177).

General comments:

- Up to the present, the only mechanism that is used to promote environmental protection in industry is that of regulations and penalties. There are no incentives to produce environmentally sound products or services, nor does the Government enter into agreements with individual companies or sectors to ensure compliance.
- The mechanism of Decrees favours short term legislation without the consent of Parliament, whereas long-term measures in favour of Sustainable Industrial Development would need the broad based approval of the Parliament.
- There is a widespread feeling that environmental legislation is not implemented sufficiently and effectively in industry.
- Some regulations do not clearly specify the entity which will be in charge of its implementation. The result may be that either too many organizations assume a role in its implementation or none.
- In some cases, the environmental regulations do not specify the penalties for breaking the rules.

Summary of laws

General Law of Health, N°5395, Oct. 30, 1973

Law of Urban Planification: N°4240, Nov. 15, 1968

Law of Waters: N°276, Aug. 27, 1942, and modifications: N°540, 1953

General Law of Potable Water: N°1634, Set. 18, 1953

Forest Law: N°7174, July 16, 1990

Law of Labour Risks, N° 6727, March 24, 1982

Law N°5438, which creates the National Service of Subterranean Waters, was approved in 1973

Project of the Basic Law of Environmental Protection and Sustainable Development Promotion, proposed on 1993 but not yet approved by the Parliament.

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Attachment IV. Sub sectoral analysis to select the pilot sector for SID policy formulation

Introduction

This first intermediate report of the UNIDO Project SIS/COS/93/801 covers the data necessary to select the pilot industrial sector for which a policy for Sustainable Industrial Development (SID) will be designed. The report was prepared at the Costa Rica Center for Management of Technology (CEGESTI) in August 1994, prior to the arrival of Mr. Mauricio Athié and Ms. Daryl Beardsley, international experts in environmental management of UNIDO.

1. Sectoral analysis of environmental impact

1.1. General data on the Costa Rican industrial base

The Costa Rican formally registered industrial base, which was responsible for 20.3% of GDP in 1992¹, has been growing at a fast pace over the past years, reaching a 10.5% growth rate in 1992 (versus a 7.3% overall GDP growth rate). The 4,569 manufacturing companies which were registered formally in 1992 mainly belong to the category of micro and small enterprises, as evidenced in Table 1. This trend is even more pronounced taking into account the almost 7000 non-formal industrial enterprises, the great majority of which are micro and small.

Table 1. Formally registered industrial establishments according to number of workers, 1992.

Category	Number of workers	Number of industrial enterprises	Share
Micro and small	1 - 19	3732	80.1%
Medium	20 - 49	453	9.7%
	50 - 99	197	4.2%
Big	100+	277	5.9%

Geographically, the great majority of industrial activities is located in the Central Valley, in which the provinces of San José, Alajuela, Cartago and Heredia meet (see Table 2). From a point of view of urbanisation and concentration of contaminants, this is clearly an undesirable situation.

¹ Chamber of Industries of Costa Rica (1994), "Guía Industrial 1994" (Industrial Guide 1994), San José, Costa Rica.

Table 2. Formally registered industrial enterprises by province (data Feb. 1994).

Province	Companies	Percentage
San José	2862	56,2
Alajuela	838	16,5
Cartago	494	9,7
Heredia	491	9,6
Guanacaste	127	2,5
Puntarenas	188	3,7
Limón	94	1,8
	5094	100,0

An important recent development for the Costa Rican industry are three major investment incentive plans under which a company or individual may operate²: The Export Contract, the Free Trade Zone System and the Temporary Admission System. All three arrangements are designed to stimulate exports from Costa Rica and to this effect incorporate a series of tax exemptions. Especially the Free Zone scheme has attracted a lot of foreign investment over the past years. In 1991, total exports from the ten established industrial free zones amounted to US \$ 200 million. The concentration of industries in free zones may give rise to concentrated environmental impact, but at the same time combined waste treatment plants are being put in place and the multinational firms settling in these areas tend to adhere to stricter environmental standards than legally required. They expect the same quality and environmental standards from the Costa Rican firms servicing them.

1.2. Selection strategy pilot sector

Table 3 shows the sub sectors of the Costa Rican industrial base and their main indicators. For a more detailed overview see Annex I.

Table 3. Main indicators of the formally registered Costa Rican industry, 1992.

ISIC	INDUSTRIAL SUB SECTOR	% of industrial added value	% of industrial workers	% of industrial firms	% of production destined for exports
31	Foods, drinks and tobacco	48,4	21,7	22,5	12,2
32	Textile products and leather	7,7	36,4	19,2	67,5
33	Wood products and furniture	3,7	4,8	13,6	45,4
34	Paper, graphic industry	7,0	5,7	8,2	11,1
35	Chemicals, rubber products, plastics	19,5	11,7	8,2	16,0
36	Non-metallic minerals	2,6	4,4	5,5	16,8
37-38	Metal-processing	10,9	12,3	19,5	35,2
39	Other manufacturing industry	0,3	3,0	3,3	27,0

² Costa Rican - American Chamber of Commerce, "Guide to Investing and Doing Business in Costa Rica", 1993 - 1994.

It is considered that the pilot sector for which a policy framework for Sustainable Industrial Development will be formulated will have to (1) be important for the Costa Rican economy, (2) have a tangible impact on the environment; and (3) incorporate a readiness for change among its entrepreneurs. Sectors 31 through 38 will therefore be evaluated according to the parameters as indicated in Table 4. For all parameters each sector will receive a percentage "Klee", which is a measure of the importance of the sector in that respect relative to the other sectors. The analysis will be brief and the fact that some of the data used is not entirely up to date is not considered critical for the outcome.

Table 4. Evaluation parameters and methodology for the industrial sub sectors.

	Parameter	Methodology/Unit
C1	Size of the sector	US \$ value added of registered companies
C2	Sectoral growth	Real growth in value added period 1988-93
C3	Sectoral willingness to change	Bank loans National Bank
C4	Aggregated sectoral air pollution	Study Ministry of Health 1988
C5	Aggregated sectoral water pollution	Data of a 1990 Costa Rican Water Utility study on BOD, SS, Nk, Heavy metals (Cu, Zn, Cd, Ni and Cr).
C6	Aggregated sectoral soil pollution	Data of a 1981 Ministry of Health study on liquid and solid waste produced per sector

The weight factors for the different parameters will be determined with the "Klee algorithm", evaluating the importance of all parameters relative to each other and then calculating an aggregate weight for each of them, as shown in Table 5. In case one parameter is considered more important than another, it will receive a value of 0.75 versus 0.25 for the one considered minor. In case of equal importance, both parameters receive a value of 0.50.

Table 5. Relative weight of the evaluation parameters according to the "Klee algorithm". The parameters to be evaluated appear on the left side.

	C1	C2	C3	C4	C5	C6	Total	Weight
C1		0,75	0,75	0,75	0,75	0,75	3,75	25,0%
C2	0,25		0,50	0,75	0,25	0,50	2,25	15,0%
C3	0,25	0,50		0,75	0,25	0,50	2,25	15,0%
C4	0,25	0,25	0,25		0,25	0,25	1,25	8,3%
C5	0,25	0,75	0,75	0,75		0,75	3,25	21,7%
C6	0,25	0,50	0,50	0,75	0,25		2,25	15,0%
							15,0	100,0%

It is considered that the pilot sector for which a policy framework for Sustainable Industrial Development will be formulated will have to (1) be important for the Costa Rican economy, (2) have a tangible impact on the environment; and (3) incorporate a readiness for change among its entrepreneurs. Sectors 31 through 38 will therefore be evaluated according to the parameters as indicated in Table 4. For all parameters each sector will receive a percentage "Klee", which is a measure of the importance of the sector in that respect relative to the other sectors. The analysis will be brief and the fact that some of the data used is not entirely up to date is not considered critical for the outcome.

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C1		0,75	0,75	0,75	0,75	0,75	3,75	25,0%
C2	0,25		0,50	0,75	0,25	0,50	2,25	15,0%
C3	0,25	0,50		0,75	0,25	0,50	2,25	15,0%
C4	0,25	0,25	0,25		0,25	0,25	1,25	8,3%
C5	0,25	0,75	0,75	0,75		0,75	3,25	21,7%
C6	0,25	0,50	0,50	0,75	0,25		2,25	15,0%
							15,0	100,0%

1.2.3. Parameter C3: Sectoral willingness to change

The sectoral willingness to invest in change is measured by the loans awarded per sub sector at the National Bank of Costa Rica, which was responsible for 62% of the loans to industries in 1993. Table 6 shows that in this period most loans were awarded to the wood and furniture sector, but that the largest amount of money went to companies involved in metal processing.

Table 6. Evaluation of parameter C3: Sectoral willingness to change, as expressed by loans awarded by the National Bank of Costa Rica in 1993.

ISIC	INDUSTRIAL SUB SECTOR	# Successful loan appl.	Av. loan (m €)	Total amount (m €)	% Klee
31	Foods, drinks and tobacco	222	9,1	2020,2	26,7
32	Textile products and leather	318	1,0	318,0	4,2
33	Wood products and furniture	571	1,0	571,0	7,5
34	Paper, graphic industry	20	2,5	50,0	0,7
35	Chemicals, rubber products, plastics	58	24,6	1426,8	18,8
36	Non-metallic minerals	73	10,9	795,7	10,5
37-38	Metal-processing	269	8,9	2394,1	31,6
	TOTAL	1531	4,9	7575,8	100,0

1.2.4. Parameter C4: Aggregated sectoral air pollution

In Costa Rica there is no comprehensive information available on the air pollution caused by the different industrial sub sectors. The air pollution data will be based on a 1988 study of the Ministry of Health, in which the industrial base was subdivided in three types of industries: (1) Consumer products (Foods, drinks and tobacco; Textile products and leather; Wood products and furniture); (2) Half products (Paper, graphic industry; Chemicals, rubber prod., plastics; Non-metallic minerals); and (3) Capital goods (Metal-processing). These types of industries were evaluated according to five criteria A through E. The sixth criteria G reflects the view expressed by experts at the Ministry of Health.

- A: Level of air pollution threat according to type of company
- B: Level of air pollution threat according to type of emissions
- C: Mechanisms of air pollution control in use
- D: Level of awareness of the types and quantities of air pollution
- E: Diesel and bunker oil consumption
- F: Expert's view at the Ministry of Health

In the context of this evaluation, each type of industry will simply be ranked relative to the others with 1, 2 or 3 (1 being the best classification). On the basis of this ranking, an average qualification of each type of industry will be calculated as follows:

Table 7. Ranking of types of industries according to different parameters determining their impact on air quality.
1: Best qualification; 3: Worst qualification.

Type of industry ↓	Criteria →	A	B	C	D	E	F	Average
Consumer goods		2	2	1	2	2	2	1.83
Half products		1	1	2	3	1	1	1.50
Capital goods		3	3	3	1	3	3	2.67

For lack of more detailed figures, the average qualification will simply be awarded to the sub sectors pertaining to the type of industry indicated above and on the basis of this average the percentage Klee will be calculated:

Table 8. Percentage Klee related to negative impact on air quality.

ISIC	SUB SECTOR	Average qualification air pollution	% Klee
31	Foods, drinks and tobacco	1.83	14.5
32	Textile products and leather	1.83	14.5
33	Wood products and furniture	1.83	14.5
34	Paper, graphic industry	1.50	11.8
35	Chemicals, rubber prod., plastics	1.50	11.8
36	Non-metallic minerals	1.50	11.8
37-38	Metal-processing	2.67	21.1
	TOTAL	12.66	100.0

1.2.5. Parameter C5: Aggregated sectoral water pollution

In 1990, the Costa Rican water utility company, in cooperation with the Israelian firm TAHAL, carried out a study into the contamination of the Rio Tárcoles, which can be considered illustrative for the industrial contamination of surface waters in the country. Four parameters were evaluated: the Biological Oxygen Demand (BOD), Suspended Solids (SS), Organic and amoniacal Nitrogens (so called Nitrogen Kjeldahl or Nk) and heavy metals (Cu, Zn, Cd, Ni, Cr). The analysis was carried out both for the period that the coffee bean processing plants were in operation (November - February) and the rest of the year. This reflects the large impact of the coffee bean processing plants on the overall contamination of surface waters. For the purpose of this overview, the results for the period that the plants were not in operation will be considered. In Table 9 the different industrial sub sectors have been ranked on a relative scale of 1 to 6, signifying increasing environmental impact. The Costa Rican wood and furniture industry has no impact on the water quality of the Rio Tárcoles and therefore receives an overall qualification of 0% Klee. The percentage Klee for the other sub sectors is based on their average parameter ranking.

Table 9. Ranking of the industrial subsectors according to their impact on surface water quality. 1: No/minor impact; 6: Major negative impact. A: Biological Oxygen Demand; B: Suspended Solids; C: Nitrogen Kjeldahl; D: Heavy metals

ISI C	SUB SECTOR	A	B	C	D	Average	% Klee
31	Foods, drinks and tobacco	6	6	6	1.5	4,88	23,2
32	Textile products and leather	5	5	5	5	5,00	23,8
33	Wood products and furniture	-	-	-	-	-	0,0
34	Paper, graphic industry	3	2	2	1.5	2,13	10,1
35	Chem., rubber prod., plastics	4	4	4	4	4,00	19,0
36	Non-metallic minerals	1.5	3	1	3	2,13	10,1
37-8	Metal-processing	1.5	1	3	6	2,88	13,7

1.2.6. Parameter C6: Aggregated sectoral soil pollution

The evaluation of the environmental impact on soils is based on a rather dated 1981 study of the Ministry of Health, in which the percentages of companies with untreated liquid and solid wastes were evaluated per sub sector. Table 10 shows the results of this study. The percentage Klee is based on the average share of evaluated firms that do not treat their liquid and solid waste (it corresponds to percentage C scaled back to a total of 100).

Table 10. Industrial companies with untreated liquid and solid waste streams by sub sector.

A: Percentage of companies releasing untreated liquid wastes

B: Percentage of companies releasing untreated solid wastes

C: Average of A and B.

ISI C	SUB SECTOR	A (%)	B (%)	C (%)	% Klee
31	Foods, drinks and tobacco	63,6	87,5	75,6	15,5
32	Textile products and leather	36,2	100,0	68,1	13,9
33	Wood products and furniture	32,0	100,0	66,0	13,5
34	Paper, graphic industry	93,5	84,6	89,1	18,2
35	Chem., rubber prod., plastics	39,1	78,3	58,7	12,0
36	Non-metallic minerals	53,8	61,5	57,7	11,8
37-8	Metal-processing	60,0	88,0	74,0	15,1

1.2.7. Results Klee methodology

With the weight factors of the different parameters determined and the parameters evaluated, we can now wrap up the Klee analysis as shown in Table 11 below.

Table 11. Results of the Klee analysis.

R[1-6]: Weighted results for each parameter (Klee percentage multiplied by weight of the parameter)

Rtot: Overall score of sub sector.

ISIC	C1	R1	C2	R2	C3	R3	C4	R4	C5	R5	C6	R6	Rtot
31	0,49	12,1	0,54	8,1	0,27	4,0	0,15	1,2	0,23	5,0	0,16	2,3	32,7%
32	0,08	1,9	0,10	1,6	0,04	0,6	0,15	1,2	0,24	5,2	0,14	2,1	12,6%
33	0,04	0,9	0,00	0,0	0,08	1,1	0,15	1,2	0,00	0,0	0,14	2,0	5,2%
34	0,07	1,8	0,06	0,8	0,01	0,1	0,12	1,0	0,10	2,2	0,18	2,7	8,6%
35	0,20	4,9	0,04	0,7	0,19	2,8	0,12	1,0	0,19	4,1	0,12	1,8	15,3%
36	0,03	0,7	0,00	0,0	0,11	1,6	0,12	1,0	0,10	2,2	0,12	1,8	7,3%
37-8	0,11	2,7	0,26	3,9	0,32	4,7	0,21	1,8	0,14	3,0	0,15	2,3	18,4%
	1,02	25,0	1,00	15,1	1,02	14,9	1,02	8,4	1,00	21,7	1,01	15,0	100,1%

1.3. Conclusions

The results of the Klee analysis clearly point toward the Sector 31: Foods, Drinks and Tobacco as the pilot sector for the effort on policy formulation for Sustainable Industrial Development. However, it is good to keep in mind that the methodology Klee, and the data used in this particular case, offer only a superficial first impression of the environmental impact of the different industrial sectors in Costa Rica. This overview will have to be complemented with first hand information of experts in industry, governmental institutions and special interest groups.

No matter which sector will finally be selected as the subject of this policy making effort, the fact that most industrial establishments in Costa Rica are small in size will have to be duly taken into account. The same holds true for the efforts on the part of the Government to decentralize the industrial development in the country.

**Annex 1. More detailed overview of formally registered industrial sector
in Costa Rica**

ISIC	INDUSTRIAL SUB SECTOR	% of industrial added value (1992)	% of industrial firms (1994)	% of industrial workers (1994)	% of production destined for exports (1992)
311	Production of food stuffs	28.42	17.89	18.23	19.06
312	Assorted food stuffs ⁴	1.26	3.09	2.10	30.88
313	Beverages	15.01	1.12	2.82	3.90
314	Tobacco	3.66	0.16	1.42	6.76
321	Textiles	2.15	3.91	7.24	49.54
322	Apparel and accessories	4.29	10.54	23.65	50.66
323	Leather products	0.45	1.38	1.05	no data
324	Foot wear	0.81	2.12	1.24	29.16
331	Wood industry	1.91	5.07	3.06	32.86
332	Furniture and accessories	1.75	8.53	2.05	1.91
341	Paper manufacturing	3.48	0.96	2.25	18.39
342	Printing and publishing	3.49	7.51	3.55	6.58
351	Chemical substances	4.00	1.71	2.57	16.09
352	Other chemical products ⁵	6.09	3.62	3.81	25.23
353	Oil refining	4.22	0.06	0.05	5.82
354	Oil derivatives	0.00	0.12	0.03	no data
355	Rubber products	1.53	1.08	1.62	78.78
356	Plastic products	3.70	2.06	3.71	26.57
361	Ceramic ware	0.00	1.87	0.80	no data
362	Glass based products	0.00	0.92	0.90	no data
369	Other mineral based products	2.56	2.56	2.28	3.48
371	Iron and steel industry	0.00	1.26	0.87	no data
372	Non-ferrous metal industry	0.00	0.18	0.27	no data
381	Metal products	2.11	8.00	3.85	25.40
382	Machine construction	1.54	2.95	1.04	22.97
383	Electric equipment	4.78	3.38	6.49	22.05
384	Transport material	2.47	4.48	1.43	2.00
385	Professional and scientific equipm.	0.00	0.75	0.28	no data
390	Other manufacturing industry	0.32	2.73	2.33	no data

⁴ Processing of fruits and vegetables, grain milling residues, starch products, prepared animal feeds, sugar products, coffee, tea, spices, condiments, vinegar, yeast, and egg products.

⁵ Paints, varnishes, inks, drugs and medicines, soap, cleaning products, cosmetics, polishes, etc.

Attachment V.- Additional Sub-Sector Selection Criteria

Criteria in addition to those presented in the "Sectoral Analysis of Environmental Impact", Attachment IV, were considered in making the selection of an industrial subsector for the SID case study. These additional criteria are presented and briefly discussed below:

Degree of centralization

Although many industrial plants are concentrated in the Central Valley, selected types of plants are distributed in different areas of the country. The degree of centralization of a sub-sector can either be:

- less centralized, in which case the distribution of SID impacts might be more in accordance with non-urban development goals of the government; or
- more centralized, thus affecting the ease with which SID policies can be investigated and their implementation overseen.

With the exception of the agro sub-sector, all sub-sectors under consideration are highly concentrated in the Central Valley.

Existing initiatives

Research and development, trade group forums, and institutional involvement for SID activities varies by sub-sector. Most notable is the intensive pursuit of water pollution reduction measures by the coffee sub-sector, which is being accomplished through the cooperative efforts of industry, government, and research institutions. Existing initiatives can assist this project by providing information already gathered and analyzed. However, the level of existing initiatives is important to consider because a high level of activity suggests that this project might duplicate efforts already initiated or have difficulty integrating its activities into the complexity of efforts already underway. In particular, existing initiatives for the coffee sub-sector suggest that this project's resources would offer greater value to another sub-sector.

State of the technology

If equipment in an industrial facility is antiquated and in need of updating or replacement, then SID can be incorporated into facility modernization. Alternatively, industrial managers may be unwilling to invest in SID if it means discarding or altering recent capital investments. Also, technologies vary in their ability to be modified for materials use efficiency, pollution reduction, recycling, or improved productivity. Little quantitative information could be gathered on this characteristic for the sub-sectors. However, it was the opinion of several persons interviewed that each sub-sector is likely to have facilities ranging from those in desperate need of modernization to those with state-of-the-art processes.

Environmental Impact

Impacts can vary significantly, depending on whether they involve: airborne, solid, or waterborne emissions; acutely toxic or hazardous materials; very large quantities, even if non-toxic; etc. Furthermore, industries affect human health and the environment

differently, according to the specifics of their activities, wastes, and locations.

The coffee sub-sector's environmental impact of greatest concern is that of river pollution. Costa Rica's leather tanning, metal mechanics, and textiles facilities tend to generate smaller but more toxic quantities of waste materials, thereby affecting the environment very differently than does the food industry's enormous quantities of organic wastes. The value of input raw materials to chemical and plastics facilities and the financial strength of the sub-sector suggests that in-plant waste reduction and recycling is worthwhile under existing market circumstances.

According to the "Programa de Control de la Contaminación del Agua" (Ministerio de Salud, Division de Saneamiento Ambiental, San Jose, Costa Rica, Abril 1982), the relative contributions of organic wastes to surface waters by industries was as follows:

<u>Sub-Sector</u>	<u>DOB in KG/Day</u>
Food & Beverage	53.4
Textiles	6.5
Tanneries	4.0
Paper & Boxes	5.1
Chemicals	3.9
Coffee	192.0

(More recent data could not be obtained. It is assumed that the relationships among subsectors is roughly the same.)

In general, air pollution is considered largely the result of mobile sources (i.e., automotive emissions). The generation and fates of hazardous and non-hazardous solid and containerized liquid wastes are not well understood at present; it is not required that records be maintained about these materials (e.g., as with manifests or shipping receipts). However, large quantities of solid wastes --primarily organic materials-- are recognized for the agro and food sub-sectors. Water is suspected to currently be the primary waste disposal media used by Costa Rican industries.

Occupational safety and health

Circumstances of employee safety and health are considered, especially in terms of which sub-sector might pose the greatest threats. Statistics provided by PAHO on reported accidents and injuries were reviewed.

Raw materials and resources (sources of)

From the perspective of SID, domestic sources, domestic processing, and domestic use of products is the most sustainable.

Exported production

Under the strictest definition of sustainable development, exports are contrary to local self-sufficiency concepts. Yet, given the complexities of society's expectations for goods and services and need for employment, there are other factors to examine regarding exports. One factor is whether the export markets are to nearby Central and South American countries. Another factor is that tradeoffs can be made between production of all needed goods and services domestically versus excess production by some industrial

sub-sectors for export balanced by import of products not producible in Costa Rica (e.g., metal resources and economies of scale do not favor truck production). Furthermore, several industry representatives have cited the difficulty in competing with the prices of imported products due to the typically greater economies of scale at very large foreign facilities. Thus, expanding export markets is a way for these Costa Rican enterprises to approach comparable or at least competitive economies of scale.

Exports play a sizable role in food product markets. Many food enterprises envision expanding export markets; some are actively seeking to develop new types of products in order to compete outside of Costa Rica. Some new products emphasize specialties (e.g., mango) not widely available elsewhere in the world.

Product type

Product attributes considered by the team include whether products produced by the sub-sector are: consumable, durable, recyclable, and/or made of recycled materials. The ability to make shifts in product attributes (e.g., convert a product made with virgin, imported materials to one made of domestically recycled wastes) as well as whether products are final, intermediate, or components are influential to sub-sector selection.

Manageability by this project

A sub-sector which offers the ability to focus on several sustainability issues common to multiple facilities, access facilities for visits and information, and coordinate with other trade and research groups is critical to the development of practical policies and programs.

Feasibility for SID

The technical and financial challenges posed by the sub-sector's facilities must not be so complicated as to prohibit near-term implementation of practical measures for increased environmental sustainability at the facility level. Institutional support for the sub-sector plus its future viability will enhance feasibility for SID.

Land use

Land use is not a particularly significant factor at the production facility level for those sub-sectors under consideration. Land use by the different sub-sectors contributing raw materials to the production facilities is important. For example: agricultural activities and their specific behaviors (e.g., pesticide use, irrigation requirements, degree of mechanization) are relevant to coffee and food products. Another example is that of cattle and tanneries. Cattle are not raised primarily to support tanneries. Instead, hide supply is a by-product of the meat processing industrial sub-sector. Thus, the relationship of cattle ranch land use to tanneries is difficult to define.

Public visibility

Public recognition of an industrial sub-sector, perception of its importance to the society, and perhaps dissatisfaction with any negative environmental impacts resulting from its facilities, will have bearing on the acceptance and support of SID policies developed by this project effort for any sub-sector. Coffee production is believed by many to have the greatest negative environmental impact; however, efforts are already underway to remedy some pollution problems in that sub-sector. Food production is recognized as both a large

sub-sector and key to social well-being. The other sub-sectors are producing high value-added products. It is unknown whether the public realizes that tanneries and chemical industries produce lesser volumes of wastes but typically more toxic wastes.

Available expertise

Costa Rican universities offer a diversity of technical expertise for industry. Creative environmental programs are underway at several universities, although support is needed for expansion of the programs. It is reasonable to expect that expertise related to agriculture be developed to the fullest in-country since techniques and technologies should be appropriate to the unique set of conditions in Costa Rica. Chemicals, tanneries, metal mechanics, and textiles are not as dependent on local characteristics of the environment. Consulting and other service professionals (for design, engineering, construction, and equipment) are not yet well versed in clean technologies, pollution prevention, and industrial-environmental sustainability. International expertise will be valuable in the near-term for timely implementation of sustainable industrial behavior. Such expertise is available for all the subsectors under consideration.

Attachment VI.- Protocol For Case Study - Visits To Enterprises

The following list of questions and issues was developed as a protocol to guide the collection of information during visits to food processing facility case studies. This protocol contains the range of candidate topics for discussion with the industrialists. However, not all were deemed relevant to each facility. In general, the Team followed the protocol's basic format but deviated from it according to: availability and type of information that could be obtained; expertise and/or responsibilities of the interviewee; specific conditions at the facility; time limitations; etc.

A. INTRODUCTORY

1. General Description of the Enterprise

- Name of Enterprise:
- Address:
- Contacts:
- When established:
- Hours/days of operation:
- Siting and layout (location sketch, neighborhood type, nearby industrial installations):
- Number of similar/total plants owned by parent company:
- Number of employees (breakdown by type, if important):
- What training programs exist for workers?
- List the process steps:
- Recent changes to the facility:
- Changes under development, planning, investigation (e.g., expansion, relocation):
- Who is assigned environmental responsibilities (waste management, worker safety, etc.)?

2. Environmental Management

- Is there a corporate and/or facility environmental policy?
- Is there a total quality management system in place?
- Is assistance needed to formulate a policy (new or expanded)?
- How is the policy implemented and applied?
- Is the policy advertised within the plant?
- What has resulted from the policy?
- What are the facility's environmental objectives?
- What environmental legislation/regulations/permits apply?
- What is the facility's history of environmental compliance or other issues?
- Does the facility have a laboratory?

3. Contingency - Prevention and Response

Are there mechanisms in place for preventing and responding to special situations (e.g., contingencies such as spills or accidental contamination of product)?

4. Product Information

- Types of products:
- Final, intermediate, or component products:
- Production (monthly/yearly production by product type or relative comparison of types, e.g., largest volume):
- Recent or upcoming changes to product line:
- Where products are marketed:
 - ♦ Are products exported?
 - ♦ Have any customers requested particular characteristics or quality for the products produced?
- Where is product packaging prepared, printed, etc.?

5. Raw Material Use

- Types of raw materials used (including any toxic/hazardous materials):
- Quantities of raw materials used (are purchase/use records kept; relative use):
- Water use (consumed, evaporation, discharged):
- Energy use (electricity, fuels):
- Sources of raw materials/inputs (domestic, foreign, another division of parent company, etc.):

6. Storage

- Describe storage of raw materials, fuels, products and wastes:
- Describe the state of such storage:
- Is an inventory system in place?
- Is obsolescence of raw materials a problem?

7. Housekeeping

- Describe the general housekeeping state of the plant:
- Describe any leakage, spills or resource waste in the plant:
- Describe any apparent mishandling of raw materials, products and any problems with equipment, conduits, etc.:
- Is there any discarded or obsolete equipment?

B. PROCESSES

Briefly describe each process step:

- ◆ inputs (major, minor)
- ◆ outputs (major, minor)
- ◆ by-products/wastes/emissions (media, receptors)
- ◆ equipment (types, age, condition)
- ◆ degree of automation / labor intensity
- ◆ operational precision (measurements, monitoring devices)
- ◆ continuous or intermittent process
- ◆ material handling
- ◆ hygiene

Changes (recent, planned, in-process, desired, unsuccessful experiments for, etc.):

For wastes contributing to pollution of:

- ◆ air
- ◆ water
- ◆ soil

Consider:

- ◆ sources
- ◆ characteristics (appearance, odor, timing, point/diffuse, temperature, outstanding features)
- ◆ mixtures
- ◆ existing controls (for treatment, recycling, handling, storing)
- ◆ existing data about
- ◆ fate
- ◆ impacts on the environment as perceived by facility personnel

C. CLOSING DISCUSSION

1. Other Managerial/Operational Procedure/Environmental Issues

Is there an on-site maintenance and/or repair crew?

How do they feel about the wastewater control requirements by MINSALUD?

- ◆ What standards will apply? Do they know what is required?
- ◆ Have they developed plans for compliance?
- ◆ Do the plans involve treatment or in-plant measures?

Describe any other pollution problems in the facility:

- PCBs
- asbestos
- ozone depleting substances (halogenated, chlorinated, etc.)
- noise
- stressed vegetation

Which waste types are mixed?

What are the impacts on the environment as perceived by facility personnel?

2. Occupational Health and Safety

What is the situation of occupational health and safety in the facility?

Is there a system in place for preventing, reporting, or attending to accidents or occupational illnesses?

Do employees use any protective equipment? Are there alarms?

D. **ADDITIONAL SID ******

How they see themselves in the SID picture for Costa Rica?

What SID plans do they have?

What help do they need to become sustainable (in terms of competitiveness and environment)?

What has helped competitiveness or environmental status in the past?

What would motivate or be an incentive to them for SID?

Have they ever considered introducing environmental components into their products for competitive reasons?

Raw materials shortages/increasing costs?

Equipment needs? Environmental services needs?

Attachment VII.- Environmental Profiles

Brief summaries of actual facility characteristics pertinent to SID are presented in this attachment for each food processing enterprise visited during September of 1994 by the SID Team. The sizes of enterprises are categorized as follows -- micro 1 to 5 employees, small 6 to 20 employees, medium 21 to 100 employees, and large 101 and more employees.

Visit 1

Main Products: Fruit products

Markets: 40% of products are exported

Size: Small

Materials Use, Handling, and Waste Management:

Since much of the fruit processed at the facility comes from non commercial farms, it is believed to be obtained from land where pesticides are not used (or not used with any regularity). Thus, pesticide chemical residues are not expected to be found in fruit products or wastes.

Incoming fruit is washed by pressurized water containing 75 ppm chlorine for disinfection. Thus, wastewaters contain chlorine. Equipment is likewise washed with chlorine-treated water.

The enterprise owns and operates one truck for the collection of raw materials, distribution of food products, and return of organic solid wastes to farmers.

Environmental Management:

The addition of chlorine to water for disinfection results in chlorinated wastewater discharges, which is not prohibited but can be harmful to the environment. This is also a common practice by food processors. Plastic containers used to contain pulps until they are processed into final product are reused as long as possible. Once damaged, they are sold to a plastic recycler. Cellulose liners are used in the molds for selected products; when dirty, they are sent to a landfill. A small quantity of waste cardboard is generated, which is also landfilled. Sugar used in some products is supplied in large 25-50 kilogram sacks. The sugar sacks' inner plastic liners are used in the facility for a variety of wastes. The outer bags are sold to farmers and others. Plastic crates for fruit deliveries were tried at one time but wooden boxes have been found to be better for this application due to their superior strength.

Expectations for Government Assistance:

Facility management finds long range business planning difficult due to uncertain market and other conditions. Government policies are sometimes too short-term in both perspective and duration due to frequent political turnover, thereby making it difficult for industry to plan well. University services are more reliable (enduring) and university researchers have been used by this enterprise on several occasions for improving facility operations (e.g., drying and milling of fruit seeds, rather than burying; development of new products). The enterprise's management believes that universities are in need of additional government funding for basic research but that university

services should not be offered to the business community free of charge because then their services would not be valued enough.

Opportunities:

As mentioned, the cellulose mold liners are currently disposed to a landfill. Although these liners are believed biodegradable, they are unlikely to have an opportunity to biodegrade in a landfill's anaerobic conditions. If compostable and free of toxics, they might be better composted with other organic wastes from the facility. If a cost-effective mechanism can be found for delivering waste cardboard to a recycler, this would be preferable to landfilling of such valuable waste. With respect to water use for washing, the facility manager suspects that less water could be used if the water pressure was higher; a system to boost the pressure would be needed. The university project for fruit seeds is attempting to find a valuable reuse for seeds (see above) rather than continuing to bury them, as is done at present.

General Impression:

While the facility is not modernized, equipment appeared to be very well maintained (in particular the ancient and probably energy inefficient boiler). Waste generation appears to be less than the norm for food processing industries. Outgoing packaging is again an issue. Some wastes, such as cardboard, are in such relatively small volume as to be more difficult to manage in an environmentally sustainable manner without a better infrastructure to aid in doing so, such as a system of pick'up of small quantity generators of cardboard.

Visit 2

Main products: Low-fat milk, sour cream, ice-cream, cream cheese, fresh cheese, mature cheese

Markets: Regional, 70 Km radius from plant

Size: Medium

Comments

The process is straight forward for dairy products: milk is pasteurized, cream is removed and homogenized; most of the semi-skimmed milk is then packed in bags and the rest is processed for cream, cheese and ice cream. Most of the waste water produced (estimated at 3 liters per second) comes from washing of vats and equipment.

The management appears very committed to ensuring that the plant complies with the requirements of the environmental laws in Costa Rica and sets an example of good environmental behavior. To achieve this, a study for the management of wastewater was prepared with foreign aid finances. The outcome of the study was the design of a \$ 5,000,000 wastewater treatment plant to improve upon the performance of an existing plant entailing de-greasing, filtering, activated sludge, chlorination and sludge disposal. No consideration was given by the design project to the reduction of wastewater generation.

There is a significant amount of discarded equipment in the vicinity of the plant. The maintenance workshop and washing of lorries are producing some soil pollution due to spilled oil and dirty water. Greasy solid wastes from the existing wastewater treatment system are disposed of in a trench, sprinkled with lime and covered with soil every five days when degreasing boxes and filters are cleaned.

Expectation from the Government

This dairy expects that MINSAL will shortly approve their proposed wastewater treatment plant, which, as usual, does not address wastewater reduction within the processes. One of the national banks, Banco Federado, and CONICIT will provide a loan for the construction of the facility.

Opportunities

A significant source of wastewater within the facility is the cheese-making process. Fluids and solids remaining after cheese formation are drained into the wastewater treatment system. Yet, this fluid contains milk proteins, or whey, a valuable nutritional product that could be recovered and sold as another product rather than being managed as a waste. Competitiveness and sustainability would be simultaneously achieved through implementation of this alternative for whey capture and use.

General impression

The efforts so far made by the plant to reduce pollution have only had limited impact. The proposed wastewater treatment investment is clear proof of the plant's commitment to improve its environmental situation. Although the proposed wastewater treatment will reduce grease, suspended solids and oxygen demand to the limits prescribed by MINSAL in the final discharge, as long as sludge and grease is disposed of without treatment the environmental problems in the plant will not be significantly reduced. One of the purposes of the new treatment facility is to improve the image of the plant and this objective can be better achieved if housekeeping in the plant, particularly in the area immediately outside the facility, is improved at the same time.

Visit 3

Main products: fresh meat, poultry, pork, processed meat (i.e. sausages, ham)

Markets: focused on the local and Central American markets

Size: large

Materials use, handling, and waste management

The animals, which are the main "raw materials", arrive alive to the facility. Once they are killed, they are hung upon hooks which are connected to a metal conveyor and are transported through the processing steps. Many waste and by-products fall into a canal filled with water, which transports them either for special processing within some part of the plant or to the wastewater treatment system. Most parts are made into some product or another. First and second quality meat is packed and sold. Some smaller pieces and

less quality meat is processed, packed and sold as sausages, ham or other products. Blood, bones and some other remainders are used in animal food. Hides are sent to a tannery for processing into leather goods. Tallow is turned into laundry soap at another plant.

Water is used to wash floors and equipment in most areas, except where at most of the plants (except for the animal food plant, where everything is powderized). A few hoses have nozzles but some others do not, and are left open during coffee or lunch hours. Waste water is the main environmental concern of this slaughterhouse. It operates a water treatment plant with an aeration system for BOD and COD reduction, plus an alleged solids separation system. The system appears overloaded and poorly maintained. Water exiting the system bears remarkable resemblance to that entering the system.

Solid waste is also a notable issue. Sausages and other processed meat products are first pressed into plastic package to give them their shape, and minutes later, they are unpacked and packed back at a plastic blister. This generates plastic packaging waste.

There are a few parts of the pipes where heat is lost by total lack of or defficient insulation.

Opportunities

The rather heavy loading to the WWTP suggests that there is a significant quantity of organic material in wastewaters which might be better recovered and added to the other miscellaneous wastes sold as animal feed. Water can be reduced by reusing the water used for transportation of remainders of the animals, such as feathers, bones, etc.

Visit 4

Main products: Cookies, pastries and crackers

Markets: Costa Rica, Central America, USA, other countries. Exports aprox. 10-20%.

Size: Large

Materials use, handling, and waste management

There is a high recycle rate for the crackers that get broken through the process. Damaged crackers are collected, grinded and reused as a raw material for the production line.

Cookies are divided into plain and special. This latter type has extra ingredients added, such as jam or chocolate. Broken plain cookies may be sold as intermediate product for other pastry shops, but special residuals are only sold for animal feed.

Product may be discarded even after it has been packaged, no recycle or reuse is presently done with the polyethylene packaging. All solid waste (except for discarded cookies) is sent to the municipal dump.

Water is not a major issue in the plant as the cleaning is done mainly by dry techniques, largely because humidity should be avoided in order to preserve cookie freshness and crispness. However, there is a wastewater treatment plant at the facility, but it is located underground which makes it hard to keep it adequately maintained for optimum performance.

Visit 5

Main products: Milled grain and grain products, some other products including potatoes

Markets: Costa Rica and Central America

Size: Large

Materials use, handling, and waste management

Grains, including maize, is received, temporarily stored, boiled, and milled into a flour. 70% of the grain becomes waste. The grains contain 40% water upon arrival and the process of making the flour reduces the water content to 11%. The evaporated water is lost to the atmosphere. A small percentage of the grains used is from Costa Rica; most is from Mexico, and some from South Africa.

With respect to water use, approximately 80,000 liters are used each 24-hour day for processing. Every 2 days, all equipment is washed down with water and chlorine (a very rough estimate of water use for this is 5000 liters); this water goes to a storage tank after which it is used to wash and transport whole potatoes around the plant. Floor areas around various pieces of equipment are bermed and have separate drains. This could support waste segregation.

Selected waste/scrap materials recovery and reuse practices in the plant include:

- In the bagging area for products, products from defective packaging and other clean products are reprocessed or refilled;
- In the bagging area for products, "second-hand" product (e.g., from the floor) is sold as animal feed;
- Flour that misses the bags upon filling is caught in a sanitary manner so that it can be refilled.

Sources of solid waste include:

- scrapings of product from production equipment is put into a plastic-bag-lined pail; unfortunately, non-edible refuse is also put into the pail, thereby preventing its reuse as animal food or otherwise;
- defective packaging;
- settled solids from wastewater treatment.

Wastewater treatment consists of: a snaked series of settling chambers; to an inclined plane settling tank; to 2 settling ponds in series where the water both evaporates and filters

through the soil (and presumably into the river below). Every 15 days, some portion of the settling chambers are cleaned of solids. They are spread on land until dry and are then sent to the sanitary landfill. When the infiltration rate of the settling ponds slows significantly (after 2-3 years of use), the solids are scraped from the bottom and sent directly to the landfill.

Environmental Management

Whether there are formal environmental management programs in place at this facility is uncertain (the SID Project Team was unable to meet with the Environmental Manager for the facility). However, several employee safety measures were noted:

- In some noisy areas, signs were up requesting use of hearing protection, and although employee use of hearing protection was inconsistent, it appeared that the company was willing to provide such equipment to employees;
- In one dusty are, no smoking signs were posted. Dust can be a flash fire hazard.

Opportunities

The enterprise is planning to expand the plant for better production volumes and quality. Clean production design should be incorporated into the new facility. However, consumer product packaging, intermediate packaging use, and the disposal of potentially reusable solids removed from wastewaters remain as outstanding opportunities to support recycling or soil reconditioning with compost.

General impression:

This enterprise is one of the stronger firms in the Costa Rican economy and thus is more likely to have the financial resources necessary to implement resource efficiency and environmental protection projects, provided that the projects offer reasonable payback periods.

Visit 6

Main products: Dairy products, some fruit juices

Markets: Most of production for domestic consumption; exports miscellaneous products to other Central American countries

Size: Large

Materials use, handling, and waste management

Because dairies are cooperatives, they must produce whatever members supply. Some milk is powdered as a way to deal with peak periods of fresh milk production (i.e., the rainy season). Powdered milk is needed for ice cream production and can be used in other products as well. Domestic milk supply is adequate for all of the production, including exports.

This dairy faces the same problem as many other industries regarding waste water management and the current treatment requirement. Due to severe space limitations in the

plant, the enterprise finds it difficult to even consider waste water treatment at its current plant but anticipates having such a plant at a planned new facility. In the meantime, the dairy has undertaken the following:

- Hired a consultant to investigate ways to alleviate wastewater problems. Through some modifications to processes (not specified), chemical contaminants in some waste waters were reduced by an estimated 70% and the volume generated was reduced by an estimated 50% (these figures are only estimates because actual measurements of water quality and quantity are not available). These efforts have resulted in cost savings.
- Contacted the government for help with ways to deal with waste water treatment, e.g., how to choose a system, what is most effective. The government suggested that the University be contacted for assistance and the dairy is now working with FUNDEVI to characterize waste streams for each type of operation.

Large quantities of water are still used for equipment, floor and truck washing.

Green plastic crates that are used to deliver products are reusable. Also, their washing has been automated (probably resulting in greater efficiency than is achievable with manual washing). Milk can washing is performed manually, using a hose of greater than 1 inch diameter running at full flow without benefit of a nozzle (i.e., no shut off). (See opportunities.)

Power supply interruptions occur 3 to 4 times per year. There are no provisions in the plant for auxiliary power for protecting product. However, the refrigerators are well insulated, the distribution trucks are refrigerated, and most product is not intended for long storage at the facility but is distributed rather quickly.

Environmental management

- The waste water volume and contaminant loading reductions that have been achieved to date were driven by a combination of: severe space limitations; the existing waste water treatment plant requirement; and complaints from neighbors regarding receiving stream water quality.
- Only one worker was observed wearing hearing protection which implies that it is made available but that most workers choose not to use it.
- The planned new plant should be under construction within the next 5 years, starting with the ice cream production portion of the facility. No EIA nor waste water management or treatment plant documents have yet been prepared although the plant layout has already been designed. A river behind the plant is the intended discharge receiving water body.

Experience with or expectations for government assistance

See above re: FUNDEVI.

Opportunities

Changing milk can washing to a different system can greatly reduce water usage for this task. One option for a new system would be to establish a contained area (i.e., bermed, so

that extensive floor washing is not needed after the can washing) equipped with spray wash nozzles over which the milk cans can be placed.

Trucks are left idling during many loading and unloading operations. A comparison of the energy trade-offs between leaving a truck running and restarting it should be made to determine when it is appropriate to shut vehicles off (i.e., if expected idle time is 5, 10, 20, etc. minutes). Not only could valuable energy (i.e., diesel fuel) be saved, but air pollution at the workplace and in the neighborhood around the plant could be reduced.

Most waste water contamination is generated in the butter production area, although greater volumes of waste waters are generated elsewhere. Currently, large volumes of hot water are used to clean the equipment, in part by dissolving the butter; water supply is via large diameter hoses, without nozzles and at high flow. Whereas the hot water is useful in clearing the equipment, it emulsifies the greases/butter fats in a way that they cannot be separated from the water. Alternative cleaning procedures might include:

- Use of nozzles for pressure spray washing and reduced water flow;
- First rinse for high concentration waste water generation and separate collection; and
- Washing of outsides of equipment with rags/brushes, rather than full force water.

Because the plant is old, redesign for water reuse may be difficult. However, the new facility can be an opportune time to implement water reduction and/or reuse schemes. No EIA nor waste water management specifics have yet been analyzed for the new plant.

General impression

Its imminent start of a new facility will give the enterprise a unique opportunity to improve its environmental record on the basis of current operational problems. Investigations into materials use and waste generation at the current facility would be expected to provide valuable information on opportunities for water reuse and other efficiency improvements, which may then be incorporated in the design of the new plant.

Visit 7

Main products: Chocolates and candy

Markets: Costa Rica and Other Central America, Puerto Rico, USA

Size: Large

Comments

The chocolate and candy manufacturing at this enterprise generates mainly solid and liquid waste. No figures are available on quantities of waste. 30-40 % of the solid waste is incinerated at the site, the rest is dumped as municipal waste. Some of the waste serves as pig or bee feed, and part of the toasted cocoa bean peels is used for floor covering in pig pens. Of the water used in the process, 60% is vented off in evaporation processes, whereas 40% ends up in a stream untreated. The enterprise sees no reason to treat its waste waters as the stream receiving the wastewaters is highly contaminated anyway.

Steam, without any chemical additives, is used to clean equipment in the chocolate production processes. Selected parts of the facility are cleaned using caustic. Bacterial contamination of product/intermediate product is dealt with by thermal treatment (i.e., cooking).

Oil spill problems have been experienced with oil deliveries.

Although some candy is packaged in bulk, much is individually wrapped, particularly small confections. Plastic is the primary packaging material used. The packaging used is printed off-site. 40 to 50 % of the printing is performed by a captive print shop. Therefore, this enterprise may have greater influence over the environmental aspects of that enterprise's printing processes.

Working conditions in some areas of the plant appear noisy and unsafe. Some areas are very dusty. The temperature in the cocoa bean roasting room is uncomfortably elevated, indicating significant heat loss and possible heat stress for workers. Regarding safety of the equipment, most equipment observed did not have guards to prevent accidental insertion of hands, etc. into moving parts. Workers were not wearing hearing protection in noisy areas. Safety glasses were not worn although the need for such is unknown.

Expectations from the Government

More specific laws and environmental regulations are expected.

Opportunities

In a "pressed" candy manufacturing area, airborne particulates of the powdered (i.e., pre-pressed) input are prevalent. Consideration is being given to the installation of dust suction systems for movement of the dust from the workspace to the outside atmosphere. While this offers worker health and comfort benefits, it represents a transfer of the problem. Ideally, sources of the dust should be identified and eliminated/minimized through equipment/process modification. Alternatively, a dust collection system which enables sanitary collection of the candy powder for re injection into the manufacturing process would be environmentally preferable to atmospheric discharge of the dust.

In the preparation of confectioneries, water, sugar, corn syrup, flavorings and other ingredients are mixed and cooked. 98 percent of the water is evaporated from the solution without recovery of heat or water from the vapor. Heat recovery could yield energy savings and condense the water simultaneously. The resulting water would be of high quality for reintroduction into confection solution preparation or another use within the facility.

There may be additional opportunities for using food wastes as animal feed.

There appears to be an interest in the use of plastic pallets for internal plant use, mostly because they are more sanitary. Each month 25-50 wooden pallets are discarded.

There is scope for cardboard recycling.

General impression

There are many opportunities for improvement, as discussed above. Environmental consciousness is only nascent at this time, but many new environmental initiative --such as for paper recycling-- are taking place.

Visit 8

Main products: Fruit products
Markets: Mostly for export
Size: Large

Comments

Due to irregular growth and lack of space, this enterprise works in very tight conditions, which affects their production efficiency. When they were established the neighboring land was used for growing coffee, nowadays it is mostly a residential area. The company has a policy of talking with the community, which has allowed them to detect potential problems (such as night-time noise) and to be able to reduce them to a minimum.

Like many facilities established in open areas long ago and now facing lack of space for expansion, this enterprise is looking for an alternative site to relocate and expand the plant. They started looking for alternative sites three years ago. One was identified and approved by IMBU and AyA. The enterprise then proceeded to survey for water and drill wells. The Municipality first objected to the project at that time, arguing that an EIA had not been prepared as required by a MIRENEM decree. A consulting firm was contracted to make a ₡ 2,000,000 study, which was completed in 5 months. The EIA Commission at MIRENEM approved the study. The project was submitted to the Municipality but the enterprise has so far waited about one year for a response.

Expectations from the Government

Although they have little hope, they expect to be granted an installation permit for the new proposed plant. The enterprise hopes the Municipality will realize that conditions in the facility are special (very little pollution and carefully controlled) and do not threaten the quality of the proposed site, especially not the groundwater, the Municipalities greatest concern.

Opportunities

The enterprise does not have any possibility of expanding its operations at the present site, and implementing improved SID measures there would likewise be difficult.

General Impression

The plants seems to be in good order, although cramped and uncomfortable. There is a high level of awareness in the Board and in the plant staff in general of the necessity to keep good sanitary conditions throughout, make an efficient use of water and raw materials and reduce waste.

Visit 9

- Main products:** Fruit pulps, mostly as intermediate products or marmalades
- Markets:** Costa Rica; bulk supplies to dairy and other food industries for use in other products
- Size:** Small

Materials use, handling, and waste management

Fruits are delivered to the plant whole and in bulk without packaging. They are unloaded from the delivery trucks onto an overhead conveyor belt which transfers them from receiving directly to washing. After washing in a water-filled stainless steel tank, the skins, seeds, and other large inedible parts are cut away by hand. Waste is drummed and the edible fruit parts are pulped. Further removal of non-pulpable or large fruit parts is conducted to achieve a smooth and even consistency for the pulp. The pulp is cooked in kettles and then transferred to a larger storage tank. When a suitable amount has been collected, it is transferred from the storage tank into an evaporator. High quality water that is driven off (i.e., distilled water) is condensed and put into water storage tanks for use in washing incoming fruit. If the fruit pulp distillate water has an aroma, then it will only be stored for use on the day of generation (unused portions are discharged). To store it for longer could produce offensive odor and/or bacterial problems. The concentrated pulp is cooled in a shell-and-tube heat exchanger. The cooling waters are closed looped. Chemical treatment of the waters was not identified.

Fresh water is used to wash down the floors and equipment of the facility. The hoses used do not have nozzles and although flow from the hose at the time of the visit appeared relatively low, water is likely to be allowed to flow during breaks in floor cleaning activities because the valve is located just outside the facility. Floor trenches carry wastewaters out of the facility for discharge into the stream behind.

Most products are shipped out of the facility immediately upon production so backup power is not essential for preservation of products in storage. It is noted that power shortages are common (although not so frequent) in the area of the plant but ordinarily do not last for more than a few hours. The enterprise is notified when a power outage is expected to be of longer duration. Therefore, although a backup power supply would help to protect product that is partway through the process when power is cut off, it is expected that this would be an infrequent event.

Raw materials are brought in on an as-needed basis. Essentially, the facility is clear of raw materials and products at the close of each day. The main exception to this is for waste materials, which are stored in metal drums for up to several days. Lower volume materials, such as sugar for marmalade, are also brought in on an as-needed basis.

The boiler and oil bunker rest on a concrete floor inside the facility and the area around them was relatively free from oil. Hot water provided by the boiler to the evaporator is recirculated back to the boiler. Chemical treatments of the boiler water were not identified.

Environmental Management

Management has an interest in using selected fruit waste for cellulose production. Relations with neighbors appear to be good. At one time, the boiler was producing offensive air emissions, but the problem has been corrected.

Opportunities

Most dewatered pulp is transferred by hose to bulk/cistern trucks for use at dairy and other final product facilities. This practice represents a minimization of packaging and waste since the cisterns are washed and reused (in the past, more pulp was put into metal drums with plastic bag liners, thereby generating plastic waste.) However, once the facility diversifies its product line to single serving or home-sized exotic fruit drinks, much more packaging will be used. An option for management to consider is the use of recycled content and recyclable beverage containers, if available at competitive costs.

There is no spill containment in the production or filling areas. Since much of the process is manual and thus under observation, it is presumed that hoses, valves, etc. can be shut off in the event of an emergency. The spillage of product is not particularly hazardous but does represent a financial loss to the company.

All waste is currently taken to the municipal dump. Some waste may be suitable for animal feed and certainly most, if not all, could qualify for composting raw material. If farmers are delivering the fresh fruit by truck, perhaps they can take back some waste for use on their farms.

General impression

The operations are currently quite efficient, due in part to severe space limitations within the facility. Given that a new facility is being built adjacent to the existing structure and that the process equipment will be reorganized in the new building, the time is right for considering further efficiency measures for sustainable operation of fruit pulp production.

Visit 10

Main products: Oils, fats and margarines
Markets: Costa Rica, Central America, Caribbean
Size: Large

Comments

The enterprise uses a variety of oils for its production. Fiber residuals remaining from the incoming palm branches after initial oil extraction undergo further oil extraction and are then used for fuel. Waste free fatty acids from the processing are used by a soap factory. Plastic packaging is extensively used for products.

Some actions have been taken in the past to improve the environmental performance of the company, be they partly for financial reasons. The pressure to do this has come from the Government, the neighboring community, and from inside. One emissions solution

required an investment of over US \$ 1 million. Apart from the environmental benefits, the enterprise was able to profit financially from this change as it is avoiding a loss of materials. Another example in process modernization, whereby new equipment has proved to be much more efficient. International experts are often brought in to help with environmental and process efficiency actions.

During the last 8 months the company has embarked upon a water use minimization program. This has already resulted in an 80% decrease in the amount of water discharged and the concentration of contaminants in the water reaching the sewer has not gone up.

Representatives of this enterprise also take part in the Commissions for Environmental Issues of the Chamber of Industries and the American-Costa Rican Chamber of Commerce (AMCHAM).

Opportunities

If this company chooses to relocate out of the city, it will have an opportunity to introduce more efficient and cleaner production processes.

Visit 11

Main products: Chicken products

Markets: Costa Rica, Central and South America, Hong Kong

Size: Large

General comments

The industrial facility slaughters chickens and processes chicken products. Quality control is mostly done visually by specially trained inspectors. The whole process is monitored by computer.

Environmental management

The main perceived environmental problem appears to be the treatment of the waste waters, which contain a lot of blood and have a high BOD. The existing oxidation pond is not effective, so there are plans to put in a new system, with the help of a University. This is all the more necessary considering that there are plans to increase the capacity of the enterprise. The new system will incorporate oxigenators, degreasers, an anaerobic filter, a biofilter, a sedimentation tank and sludge tanks. Its approximate cost will be US \$ 150,000.

The practice of internal and external re utilization of solid waste coming from chicken rearing and slaughtering appears to be well developed. As an example, a company called "SALVAGANADO" processes a mixture of chicken droppings/urine/shreds of paper, used as floor covering at the chicken farms into fertilizer, or, if mixed with molasses, into cow feed. Alternatively, ground chicken feathers, heads, feet and blood are mixed with palm kernel oil and then cooked into a substance called "TORTAVE". This is then mixed with corn, soybean meal, vitamins, molasses and fish flour to get chicken feed.

Opportunities

This enterprise is a typical case of an industrial facility where end of pipe measures still prevail when it comes to wastewater management. There should be ample opportunity to achieve savings in water and energy usage within the plant and the projected new water treatment facility might be scaled down correspondingly. The transport of the feathers, for instance, is done with a combination of clean water and water which comes from the chicken washing installation, but is then used only once. It should be relatively easy to design a closed loop water transport system here or even a dry transport system for the feathers.

It may be interesting for the enterprise to study the possibility of a dry chicken slaughtery process, which will have positive quality as well as water usage implications.

Visit 12

Main products: Processed meat products

Market: Costa Rica

Size: Medium

Comments

Four years ago the facility was extensively upgraded with the help of CITA and the University of Costa Rica. A quality control program was recently introduced as well.

Most animal parts are utilized within the plant. Very little waste is collected from cleaning operations (scull bones, flesh remnants, grease, etc.). Waste is sold or given away for reutilisation, incineration for further reuse and/or disposal. An old oxidation ditch for waste water treatment did not function properly, was recently re-engineered, and is to be opened again soon. Treated waste water will be discharged into a tributary of river Tárcoles.

Opportunities

There are still a number of opportunities for reduction of water use and greater utilization of materials. The provider of services for waste management and disposal might need closer supervision to ensure adherence to the same high standards as the enterprise itself.

General impression

The plant seems to be in good order. There is a high level of awareness in the Board and in the plant staff in general of the necessity to keep good sanitary conditions throughout, make an efficient use of water and raw materials and reduce waste. There is a good chance that opportunities for further efficiency improvement will be acted upon.

Visit 13

Main Products: fresh and frozen seafood products

Markets: 90% is exported

Size: Medium

Materials Use, Handling, and Waste Management:

Different types of wastes --especially bones, skin, and mixed miscellaneous waste not easily classified for special use-- are drummed separately to ensure maximum use value. (Note that the fish are gutted and de-gilled by the fishermen on the boats.) Uses of the fish wastes include nutritional supplements and fish meal.

Water is used for washing and ice-making. Water supply expenses have been reduced by approximately 70 percent in the past year, despite rising water costs, due to the conservation measures described below:

- recycling of waters used in the "thawing chamber" of the ammonia-based cooling system;
- use of spray and/or pressurized nozzles;
- downsizing of hoses from 1.5-inch to 0.5-inch diameter;
- training for employees about efficient water use; and
- purchase of pressurized, hot water mobile cleaning units.

Opportunities:

Outstanding issues for this facility include:

- how to get timely and reliable laboratory analyses performed on water and fish qualities;
- what can practically (i.e., per cost and performance) replace the one-way styrofoam boxes currently used to ship product;
- what to do to reduce energy consumption; and
- what can be done to recover and reuse or replace the chlorine currently used in cleaning operations.

General Impression:

Most waste reduction measures implemented at this facility appear to have been financially, rather than environmentally, motivated. The mobilization of the enterprise to reduce water costs has led to a greater awareness on the part of employees about efficiency of operations. Furthermore, the enterprise encourages employee input and recently awarded a prize to an employee who suggested that re-usable straps be used to secure boxes rather than the large quantities of tape previously used. Improvements in fish transport/movement procedures have reduced the handling of a fish from 16 to 6 times, resulting in less damage to the fish, less ice use, etc.

Visit 14

Products: Vegetable and fruit sauces, blended and packaged

Markets: Exports are 8 to 10% of sales

Size: Large

Comments

The company has grown a lot over the last two years. The processes have become more automated and production has diversified.

Environmental management

There is a corporate policy to minimize the environmental impact. This policy (as part of the general company's policy) is advertised within the plant, but this is as far as the implementation goes. The management would be willing to invest in environmental protection in case there were incentives from the side of the Government to do so (such as a reduction of income taxes).

Raw Material

55% of the value of the product is glass and packaging materials (bought on the local market).

Tomato pulp and spices are imported and stored at another facility

Bunker is used for energy (spills go with the wastewater)

Humidity sometimes causes problems with materials in storage.

Processes

Water is used mainly in washing the equipment and the floors.

The water consumption is 1300 m³ per month

Solid waste is sent to the municipal landfill

Waste glass is sent back to supplier VICESA.

General impression

Eventhough the management has not taken specific action to protect the environment, it can be considered open minded and innovation oriented.

Attachment VIII. Program and participants list of the December 7 seminar.

Seminar: Sustainable Industrial Development in Costa Rica - Program

	<i>Subject</i>	<i>Speaker</i>
08:30-09:00	Inauguration	Ing. Javier Rodríguez Arias, Director of CEGESTI
09:00-09:45	The concept of Sustainable Industrial Development Conclusions of the diagnosis of the environmental record of the food processing industry	Mr. Mauricio Athié - International Expert on Environmental Management Ms. Daryl Beardsley, International Expert in Industrial Auditing
09:45-10:30	The National Program for Science and Technology and Sustainable Industrial Development	Mr. Eduardo Sibaja - Vice Minister of Science and Technology
10:30-10:45	<i>Coffee Break</i>	
10:45-11:45	Policy menu for Sustainable Industrial Development	Mr. Mauricio Athié
11:45-12:30	The role of the Chamber of Industries of Costa Rica (CICR) in the promotion of SID	Mr. Luis Fernando Arce, Coordinator of the Commission for Environmental Issues of CICR
12:30-14:00	<i>Lunch</i>	
14:00-15:00	Policy recommendations for institutional strengthening Case study: Cooperation agreement for plastics recycling	Mr. Mauricio Athié Mr. Sergio Goñi, Manager of RECYCO
15:00-15:45	Policy recommendations for environmental management	Mr. Mauricio Athié
15:45-16:00	<i>Tea break</i>	
16:00-16:30	Policy recommendations for financial support mechanisms	Mr. Albert Keesman, CEGESTI
16:30-17:00	Our common efforts towards Sustainable Industrial Development	Mr. Javier Rodríguez, CEGESTI Mr. Alejandro Esquivel, Director of the Sectoral Commission for Sustainable Development

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Attachment IX.- Policy Planning Principles For Implementing Sustainable Industrial Development

Efficient Use of Natural Resources

Efficient use of natural resources available to Costa Rica is largely a question of which inputs to use in producing goods and services.

An Information Base

In order for efficient use of natural resources to be made, much information must be gathered, analyzed, and applied properly. The following questions would be answered from different perspectives by industrialists versus governing authorities due to the different responsibilities for and interests in resources.

- what resources are available?
- what resources are being used?
- how are resources being used versus how should they be used?
- what are future needs for and opportunities offered by forthcoming equipment, techniques, technologies, etc.?

Industry finds answers to the first three questions by using financial measures. Industry bases its actions upon market prices for resources and resource services associated with manufacturing operations (e.g., water supply, energy supply, waste disposal) and their influence upon production costs. It also considers what customers are willing to spend to satisfy their demands. Its form of efficiency is heavily dependent upon the cost and benefit balance between being wasteful and being efficient. For instance, if the costs for equipment modernization cannot be offset by the associated improvements in resource efficiency, then the status quo for resource waste will continue. Nevertheless, many industrial managers need to be taught how to account for all costs of production - energy, water, sewer, waste disposal, worker health care as influenced by exposure to hazardous substances, etc.

Government, on the other hand, is faced with a complex task of trying to manage all resources available to its constituency from a perspective of social goods and costs. Government intervention into resource markets may accelerate the process of incorporating what are currently externalities (e.g., environmental degradation compensation, health effects) into market prices. Basically, the importance of being efficient with any particular resource may be reflected by the costs associated with that resource; cost is important information for industrialists. Current inefficiencies and environmental degradation suggests that costs are not reflecting SID goals at present. In Section 3.2.3, a policy option reflects this concern.

With respect to the last question, technical information must be developed to help industrial enterprises make choices that will enable them to operate in more sustainable ways. Some technologies may be borrowed from international sources while others may need to be developed within Costa Rica to adequately address specific local conditions and circumstances. Section 4.1.3 discusses the use of a consulting services sub-sector as a means for developing such information.

Measurement Techniques

As was mentioned in connection with information issues above, government and industry will have different needs for measurements related to SID. Government will be more interested in macro measurements of how resources are:

- extracted or otherwise provided (domestically or through import);
- used (domestically or for export, for what types of products and services); and
- disposed (how and where).

Industry will focus on micro level issues of how resources are used within facilities to generate production output. The first task of industrial enterprises will be to collect information pertaining to conditions within a facility:

- purchase records for types, quantities and prices of resources used;
- product shipment data, including what types and quantities of materials are embodied in the product; and
- types and quantities of emissions to air, water, and land (not just in terms of concentration but also total loadings).

Emissions data in particular may require use of monitoring devices and analytical laboratories to define the contents and quantities of emissions. Ideally, this information for Costa Rican enterprises would be compared against recognized standards for production efficiencies and emissions so as to identify what requires attention, modification, replacement, or elimination within a facility.

Audits are often used to collect and analyze the information mentioned above. Consultants can be critical to the implementation of measurement techniques; they will seek to develop and use them to carry out SID consulting services.

Prioritization of Resource Use Options

To help industries understand which resource use paths are more sustainable for their production processes, information on the relative merits of resource use options would be valuable (e.g., are renewable wood products preferable to recycled plastic products for construction). The prioritization of resource use options is best performed by an authority capable of evaluating resources from a national and international perspective. Nevertheless, some industrialists are bringing this analysis to the enterprise level by attempting to perform life-cycle assessments of products and services that they provide. Reasons why industrialists may pursue this include that they are interested in positioning themselves for the future, improving public image, attracting environmentally-conscious investors, and avoiding future environmental liabilities.

Resource use prioritization will be influenced by whether resources are characterized as:

- in abundant supply;
- native to Costa Rica or imported;
- renewable or dwindling in availability;
- already recycled by domestic or international enterprises; or
- non-toxic, and/or non-hazardous.

Attachment X.- Techniques and Technologies for reduction, reuse and disposal

Efficient Resource Use and Pollution Prevention through Clean Technologies

For the purposes of an SID discussion, the following techniques are all considered relevant to "Clean Technology":

- pollution prevention;
- waste minimization;
- source reduction;
- green design and redesign;
- resource efficiency; and
- industrial ecology.

Pollution prevention techniques and technologies focus on in-plant changes to processes for the minimization of waste¹ (which becomes pollution) generated by: leaks, spills, careless materials handling, fugitive/non-contained dust, trimmings, incomplete reactions, chemicals used for product treatment but not embodied in the final product, defective products, cooling tower and boiler maintenance activities, etc. Prevention is accomplished through process modernization (i.e., efficiency improvements). An ever-expanding concern in the field of pollution prevention is on the use and fate of products: do they pollute in use (e.g., volatile organic compound emissions from paint) or when disposed. Green design of products can alleviate those concerns.

Reuse and Recycling Inside and Outside the Plant

Waste materials may be *reused* directly in the same process or in another (e.g., waste oil from vehicles may be used "as is" in a piece of fuel burning equipment). Alternatively, they may be *recycled* (i.e., reconditioned, manipulated, modified) to be employed:

- for different purposes; or
- back into the same production process but at an earlier stage than where the waste was generated (e.g., in glass-making, scrap bottles must be reground and melted before reforming being reformed).

These activities may take place within the operations of the facility generating the waste or they may be better used by a different process altogether, either inside or outside the plant, either on-site or off-site.

Although reuse and recycling helps to eliminate the waste of natural resources, these activities can often only be accomplished with the use of extra resources (e.g., energy, wash water, chemicals for extraction, reprocessing equipment). Thus, whereas reuse and recycling is preferred to treatment and disposal, they are inferior to efficient resource use and other preventive measures. Nevertheless, their role in the near term is expected to be important as a way to deal with

¹ Waste minimization is simply the reduction of the amount of waste generated per unit of output.

inefficiencies of existing enterprises which cannot be corrected due to technical and/or financial constraints. (see Section 3.2.2., Waste Exchange, creation of clean technology enterprises - recycling firms).

Safe Treatment and Disposal of Wastes

Wastes for which prevention, reduction, reuse, or recycle options:

- do not yet exist;
- are not completely effective;
- are not available for the scale of the process in question (too large or too small);
- will take time to coordinate among suppliers, recyclers, etc.; or
- cannot be financially justified under current resource, equipment, and services pricing conditions;
- may need to be treated and/or disposed.

If it is believed that there is no completely safe disposal method, treatment and disposal may be regarded or organized as interim measures. Interim treatment might arrest decay processes or separate materials for different disposal. Interim disposal would function as secure storage in the near term until a beneficial use could be made of the waste (e.g., until technology advances sufficiently to extract and reprocess valuable materials from the waste into a usable form).

Attachment XI.- The Nozzle Program

A. Introduction

Inspection of a diversity of facilities representing principal food processing types in Costa Rica revealed a common condition: excessive water use. More specifically, it was noted that in the majority of cases, hoses used to dispense water for cleaning lacked flow rate, pressure, and shut-off controls. A minority of facilities used nozzles to provide such control. Because:

- the use of nozzles should be standard industrial operating practice,
- relatively little effort and expense is necessary to implement water conservation through the installation of nozzles, and
- nozzle installation would represent a good housekeeping practice and all such practices that bring a facility up to optimal operations under existing process design make the adoption of further modifications for sustainability more efficient,

an initial SID program in which government and industry may participate has been developed.

B. Industry Responsibilities Under the Nozzle Program

Below are proposed steps to be taken by industrial facility managers participating in the nozzle program. Industry association involvement with several of the actions is envisioned.

1. Evaluate existing water uses:

- Where are hoses without nozzles used? Are their sizes appropriate to the application or should they be changed (for instance, reduced hose size may reduce nozzle costs)?
- Where are hoses with nozzles used? Are any in need of replacement (change of design or size)?
- Are there any additional locations where a hose and nozzle would improve water use management? Solicit employees for ideas.

2. Tabulate the number and types of nozzles and new hoses needed.

3. Record current water use to the extent possible. Make estimations if necessary. Preferably identify water use by application.

4. Organize with other enterprises (perhaps through an industry association) to arrange to purchase nozzles from a supplier. Collective bargaining may result in financial savings and better service for repairs, etc.

5. Install nozzles (and hoses).

6. Train employees about the use and significance of nozzles (again, an industry association may be of assistance with training materials, etc.).

7. Measure the impact of the nozzle installation in terms of changes in water use and performance of tasks (e.g., is cleaning simplified, how are maintenance activities affected).

8. Analyze wastewater qualities by segregated source, if possible. For example, sample the first rinse of a mixer and the final rinse and use the resulting analyses to prepare for contaminant reuse, recovery, or treatment activities. This activity is contingent upon analytical laboratory services being available (see below).

C. Opportunity for Government Involvement in the Nozzle Program

The Costa Rican government's involvement in this proposed program is critical if the benefits of nozzle installation and use by industrial facilities are to include further progress towards SID. While environmental and conservation (savings for industry) benefits can be realized by the nozzle program alone, the underlying intent of this program is that it serve as a foundation for more sophisticated SID pursuits. So significant have been the water use reductions by some facilities using nozzles for water use control, that the country-wide adoption of this simple technology will help to raise all industrial facilities to a common starting point. From that point, the government can help industry to investigate and resolve other problems of efficient materials use and pollution prevention.

Ways in which the government can contribute to the overall goals of SID include:

- Recognize source reduction, pollution prevention, and clean technologies as acceptable alternatives to wastewater treatment plants.
- Assist with the establishment of analytical laboratory capabilities to service industrial facilities: needs for assessing the impacts of nozzle use, preparatory to the pursuit of other SID activities (see the six water and wastewater management areas identified in Attachment XII). Initially, the analytical services might be provided by a university or several universities. It is suggested that only a few analyses be available at first:
 - ♦ to limit the expense of equipment acquisition;
 - ♦ to minimize the costs of the analyses (due to high volume of only a few analyses);
 - ♦ to simplify the first stages of developing a system for collecting, logging/tracking² analyzing, and reporting on industrial process and waste waters in a timely and accurate manner.
- The analyses offered should cover at least the following parameters:
 - ♦ pH;
 - ♦ total suspended solids (TSS);
 - ♦ total dissolved solids (TDS);
 - ♦ biological oxygen demand (BOD);
 - ♦ chemical oxygen demand (COD);
 - ♦ fats, oils, and grease (FOG).

² Anonymity of sources might also be a feature of the logging/tracking system for samples received for analysis. Industrial facility operators may be more likely to investigate waste issues if they can do so in the spirit of gaining a good understanding of process behavior, rather than feeling exposed to criticism of existing conditions.

D. Feasibility

Issues affecting individual facility feasibility of adopting this program include:

Labor

- ◆ hose identification (number and size);
- ◆ decision whether to change hose sizes;
- ◆ installation/attachment of nozzles to hoses;
- ◆ training for employees in nozzle use and maintenance.

Expenses

- ◆ hose replacements, if any;
- ◆ nozzles purchases;
- ◆ laboratory analyses of impacts (optional and contributory to further SID activities such as waste recycling).

Savings

- ◆ water supply;
- ◆ improved waste management;
- ◆ energy, if heated or cooled water is used.

Operational Advantages

- ◆ more control of wastestream heading to recovery or treatment units;
- ◆ enhanced employee task performance - less time to go to and from shut off valves; less flooding and problems thereof; if adjustable spray nozzle, type of spray can be tailored to the application's needs (e.g., employees do not need to use fingers over the ends of hoses to create a spray effect).

Complications

- ◆ nozzle damage (dropping, run over by fork lifts);
- ◆ recirculation of wastewaters containing particulates can clog nozzles.

E. Measurement of Program Effectiveness

Theoretically, nozzle use should yield water conservation benefits. However, the effectiveness of the program ought to be confirmed and, if possible, a measure of the magnitude of its effectiveness should be made. The following procedures will contribute to that measurement:

- Assess water usage prior to the installation of nozzles, smaller diameter hoses, and/or new hoses.
- At a minimum, or if direct measurement data is not available, compare water supply bills from before and after installation of the new equipment. A substantial period of time covered by

both before and after bills may be needed for a fair comparison, particularly if water usage by the facility is seasonally affected.

- Solicit employees for their comments about:
 - ♦ how their water use activities have been impacted (easier or more difficult, and why);
 - ♦ water savings estimates; and
 - ♦ any observable changes in wastewater quality.
- Some facilities may have water meters installed which can be used to measure the changes in water use.

F. Benefits to Future SID Efforts

The primary contributions made by nozzle use to subsequent SID efforts are:

- reduced wastewater generation - smaller treatment systems, smaller pumps, smaller storage tanks, etc.
- greater control of waste streams - collection of waste in a more concentrated form facilitates recovery and reuse for food, compost, or other value.

Attachment XII.- Water And Wastewater Management For Sid

Presented herein are methods for promoting SID in the food processing industrial sub-sector. These methods may be relevant for other industrial sub-sectors as well. The focus is on near-term feasibility for: (i) water conservation and (ii) waste recovery and reuse/recycling. Nevertheless, suggestions for middle- and long-term efforts are also proposed. Initial efforts proposed are designed to lay the foundation for ever-increasing resource use efficiency, thereby advancing sustainability of the sub-sector. The intent is to gradually develop and implement a coherent, long-term water use management plan that is consistent with SID strategies.

Water use in industrial facilities is significant to pollution prevention (i.e., sustainability) efforts primarily because water often serves as a vehicle for waste materials transport and discharge from a facility. Furthermore, high volumes of use can:

- produce a larger volume of waste, albeit of lower contaminant concentration;
- necessitate larger equipment and greater energy use for management of both process waters and wastewaters; and
- result in high costs of water supply and wastewater discharge.

A series of water and wastewater management programs are briefly described below. The programs are presented roughly in the order in which they are recommended for implementation. Varying physical, procedural, and financial circumstances at individual facilities will, however, dictate the most appropriate implementation sequence of SID measures undertaken by any one enterprise.

Develop a Better Understanding of Water Uses and Wastewater Generation:

To develop this understanding:

- (1) make a list of all water using processes in the facility;
- (2) note which of the processes generate a wastewater;
- (3) estimate the amount of water used by each process, by flow rate or total volume per hour or day (and how is use regulated - manually, electronically, etc.);
- (4) estimate what percent of the water used is discharged as wastewater;
- (5) determine what materials are in the wastewaters, and at what concentration (if quantitative measurement is not possible, qualitative evaluation of high, moderate, or low concentration should be recorded);
- (6) indicate which wastewater streams are combined; and
- (7) identify water using processes that might be tolerant of using lower quality waters (i.e., wastewaters generated by the same or another process).

The data suggested for collection is amenable to organization in a table, which will also make it easy to access and use. Back-up information, such as laboratory analytical reports, can supplement the table.

Reduce Water Use Where Possible:

Information gathered through the previous effort can be used to select candidates for water use reduction. Reduced water use might be realized through the use of different equipment (e.g., constricted flow devices, redesigned easy-to-clean production equipment), new water handling procedures (e.g., first rinse for collection of wastes in a highly concentrated form), or entirely new production methods that do not use water (e.g., dry wiping for cleaning).

Segregate Wastewaters by Type of Wastes Borne:

Segregation of waste types achieves two objectives: it simplifies treatment of wastewaters, and it maximizes the value of recovered wastes. In general, the more complex a wastestream, the more complex are the systems needed to remove each of the unique wastes and to prevent undesirable interactions among the mixture's components. While some wastes can be mixed and still find a reuse or recycling value, it generally narrows the options for the wastes; it is preferable to have the choice of mixing wastes as desired. Segregation of wastewaters may require repiping, new storage tanks, and other changes to the physical layout of a facility.

Recirculate and Reuse Waters Directly:

Once segregated, wastewaters of varying types might be matched to water needs that are tolerant of the contaminants or other altered qualities (e.g., temperature, pH) of the wastewaters. Just as segregation of wastewaters requires structural modification of a facility, so do measures taken to enable recirculation or reuse. For example, a wastewater generated by one process would need to be conveyed at an appropriate time or rate to its reuse application.

Recondition Waters for Reuse:

Since processes may not always be tolerant of the lower qualities of wastewaters, it may be necessary to recondition wastewaters prior to their reuse. Particulates might be removed by screening, hot waters may be allowed to cool in a storage tank or by being passed through a heat exchanger, the pH might be adjusted with acid or caustic chemical additions, etc. These activities represent the next level of complexity and financial investment for implementation. Reduced water costs help to offset the expense of implementation.

Recover Materials from Wastewaters:

Since valuable materials not efficiently used by the production process are often the contaminants in wastewaters (e.g., residual milk solids in dairies, meat scraps and blood from slaughterhouses, flour from cereal and grain products facilities), recovery of those materials from wastewaters may have some marketable value as animal feed, soil conditioners, fuel, etc. The materials may be recovered for reuse on- or off-site. Further processing may or may not be required. Recovery of the waste materials may be the result of water reconditioning activities or it may be undertaken without resulting in sufficient water quality restoration to enable reuse of the water in-plant. Resale value of the recovered materials (and/or reduced waste disposal charges) should provide a return on the investment in recovery systems.

There is no exact sequence according to which these measures should be pursued. At some industrial facilities, the adoption of water conserving, materials efficient, and/or waste recovery measures may proceed very slowly due to a wide range of processes. An enterprise might find that it must invest in large and expensive facility modifications due to a large scale of operations -

small, incremental changes would be impossible. In some cases, the opportunity to benefit financially from waste recovery might be best realized through simultaneous implementation of segregation, conservation, recirculation, and recycling systems, rather than through a gradual implementation process.

Attachment XIII - Ordering Criteria for Policy Options

Annex to section 3.1

Ordering criteria for policy options

The policy options in Table 1 (Chapter 3) were given an order according to the following criteria. Policies in italics were developed further by the SID team as described in Chapter 4.

Ordering criteria

- C1. Suitability. Importance of the policy measure for the implementation of Sustainable Industrial Development (SID)
- C2. Bankability. Attractiveness of the policy to receive support from donors, the government and the private sector as well as proven availability of funding for that purpose.
- C3. Sequence. Timing of implementation according to a logical sequence.
- C4. Degree of urgency.
- C5. Degree of support from the Costa Rican private sector
- C6. Degree of support from the Costa Rican Government
- C7. Perceived chance of success for demonstration purposes
- C8. Positive effect on competitiveness of Costa Rican industry
- C9. Availability of information at the time of policy formulation

On the basis of the above criteria, the policies chosen for further elaboration were the following:

- Strengthening MINSAL
- Strengthening CONEIA
- Strengthening Consultancy
- Voluntary Code of Environmental Conduct
- Soft Loans and Incentives for Clean and Efficient Technology Application